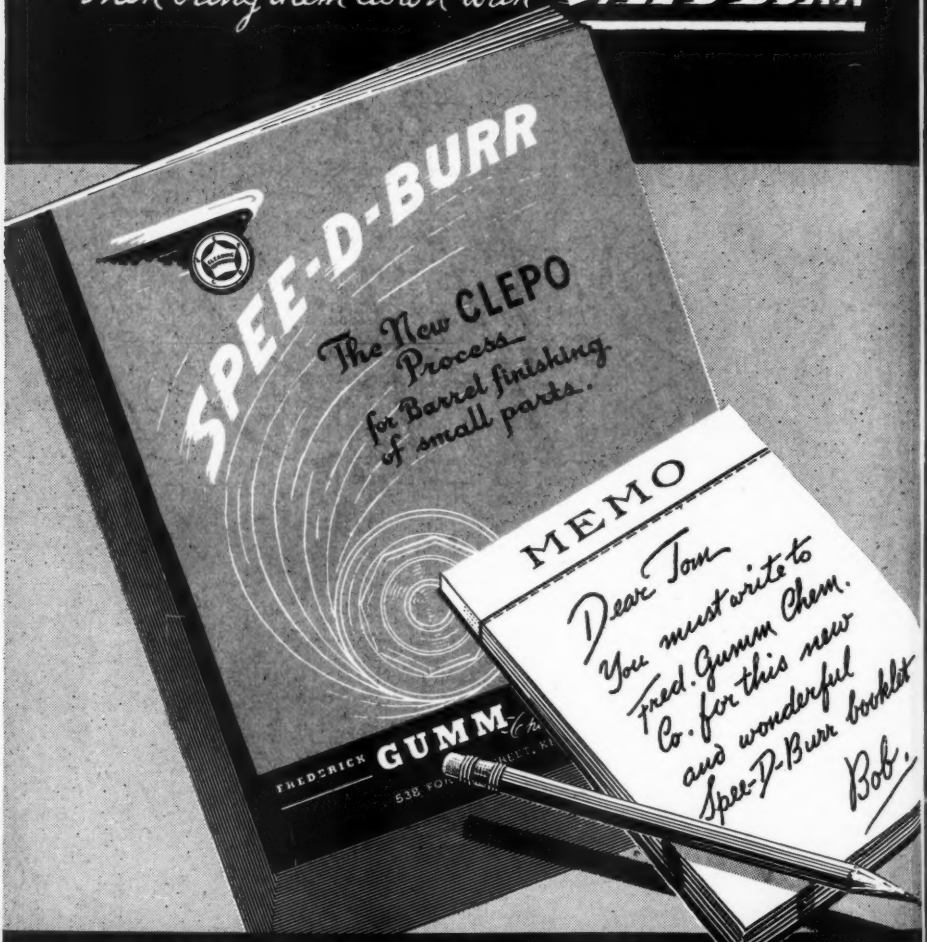
THE MONTHLY

Review

SEPTEMBER · · · 1947

DID YOU EVER **WATCH**
YOUR **OC*** GOING UP
* OPERATING COSTS
Then bring them down with **SPEE-D-BURR**


SPEE-D-BURR
The New CLEPO Process for Barrel finishing of small parts.
FREDERICK GUMM
MEMO
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Bob.

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A POWERFUL NEW EMULSION CLEANER

. . . Safe for the Plating Room . . .

Emulsion Cleaner 75

ENTHONE Emulsion Cleaner 75 is a new development in emulsifiable solvent cleaner. It possesses the solvent powers of aliphatic hydrocarbons and, at the same time, disperses instantly in water. Used as a pre-soak, its great penetrating powers insure thorough cleaning of recesses and crevices—all oil, grease and solid dirt removed.

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2. Leaves no objectionable odor.
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ENTHONE, INC. Metal Finishing Chemicals 442 Elm

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DETROIT · 26 · MICHIGAN
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THE MONTHLY

Review

VOLUME 34 SEPTEMBER, 1947 NUMBER 9

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PRODUCTS	Baths easily made up from prepared	[illegible]

APPLICATIONS	For all types of zinc plating, particularly barrel plating. Satisfactory	For steel surfaces of almost any size or shape.
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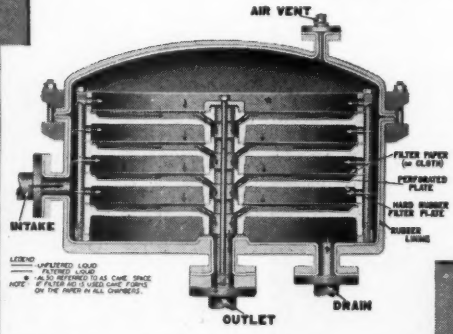

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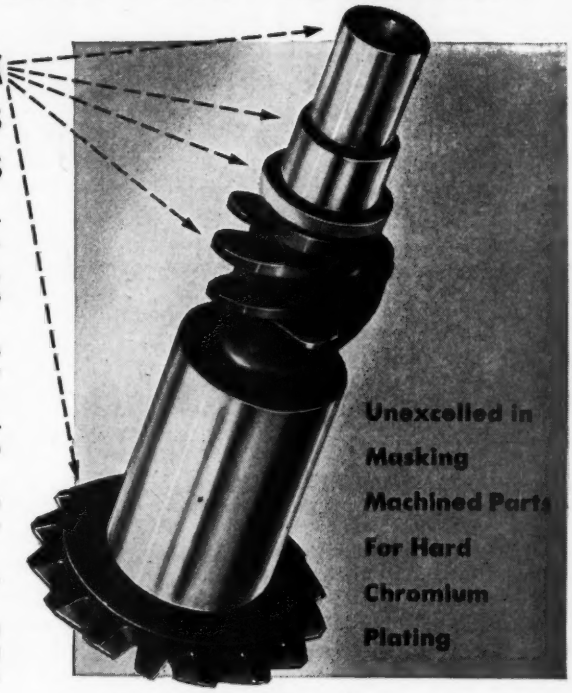

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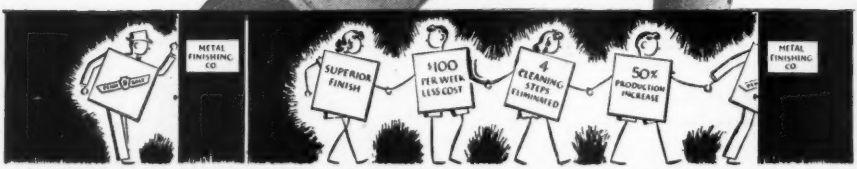

AND BROUGHT A WHOLE FAMILY ALONG!

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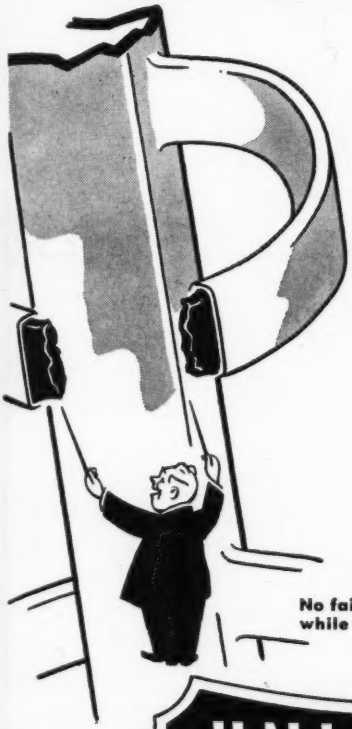

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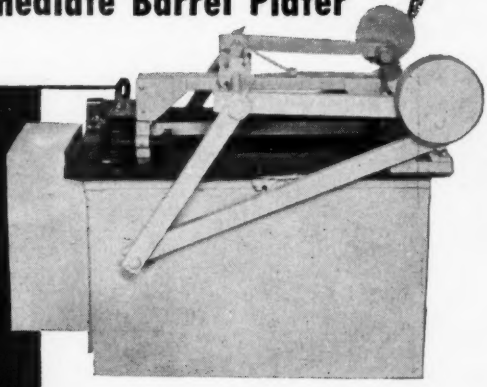

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Miller's Synthetic Glue, another of the celebrated Miller Quality roducts is *your answer* to the glue shortage and search for the erfect wheel adhesive.

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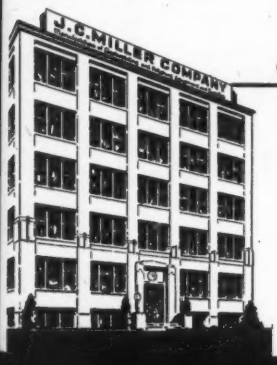

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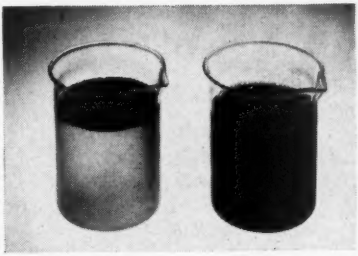

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FOR AMERICAN INDUSTRY

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Potassium Titanium Fluoride

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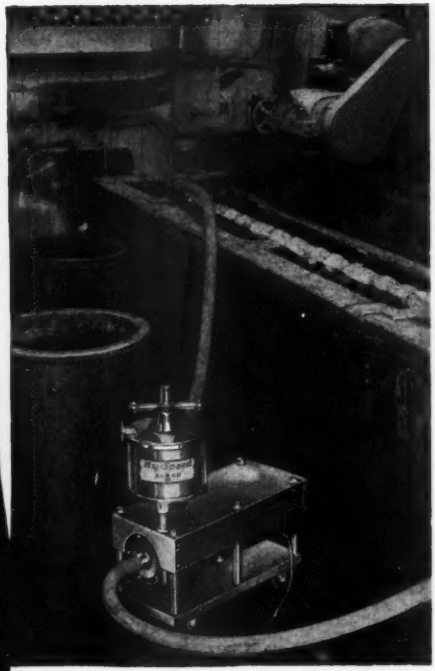
The FILTER that Plating Shop Men Are Buying... ...ON ITS REPUTATION



Outstanding for protection against pitting, spotting, poor adhesion, formation of nodules, etc., which mean rejects and reworking, "*Sealed-Disc*" Filters have won high reputation in plating rooms large and small all over the world.

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ALSOP ENGINEERING CORPORATION

Filters, Filter Discs, Pumps, Tanks, Mixers, Agitators

THE MONTHLY
Review

EDITORIAL

A. E. S. MILESTONES

With the close of the 34th Annual Convention, another and most important milestone in the Society's history has been passed.

The largest attendance at a convention, the greatest Industrial Finishing Exposition, the excellent technical sessions and the wholehearted cooperation of the members of the Detroit Branch in handling the convention are all recorded in the minds of the visitors and in the archives of the Society. We are indebted to George Nankervis and his Convention Committee members for this history-making milestone in the Society's record.

The active interest shown by many Branches in the proposed revision of the Constitution indicates that the members are concerned in the operation of their Society. This interest clearly demonstrates the youthfulness, ambitions and clarity of thinking on the part of the membership. This is truly a healthy condition.

The health of this interest is further demonstrated by the activity of those members who can trace their membership back for many years, even to the founding of the Society, and who are still helping us youngsters steer a proper course for this growing educational organization. May their interest never cease.

The wholehearted cooperation of the Delegates in accepting the budget and providing the Executive Board with means of strengthening the financial foundation of your Society is a tribute to the confidence the Delegates have shown in the National Officers.

The coming year promises to be a busy one for your Executive Board. Art Logozzo will be the chairman of the five-member Constitution Revision Committee. Each member will represent a geographically determined group of Branches and will be charged with the responsibility of

correlating all the ideas of the Branches in his district. It is requested that the President of each Branch have his Branch's views ready for submission to his representative by the early part of September. This is imperative in order that the proposed revision be published in January.

The Educational Chairman will be busy in completing plans for educational aids to interest high school students in metal finishing and having colleges offer subjects of interest to those wishing to specialize in metal finishing as a career.

The Membership Chairman's chief interest is to see the membership of the Society cross the 5,000 mark.

The Exhibits Chairman has set as his goal a Convention Exhibit in which every Branch will participate. This goal has not been attained since 1939 in Asbury Park when Newark was the Host Branch.

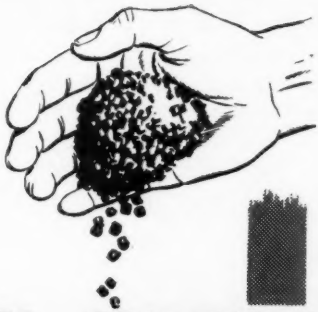
These goals—a New Constitution, Metal Finishing Courses in the high schools and colleges, a Membership of over 5,000, and every Branch represented at the Exhibition—cannot be attained by your Officers. They can only be reached by *each and every member* placing his shoulder to the wheel and making the wheels in this highly geared educational Society drive with the precision of a fine chronometer.

Do your part to make the next milestone, the 35th Convention in Atlantic City, the most significant one in the history of the Society!

Ken Heaston

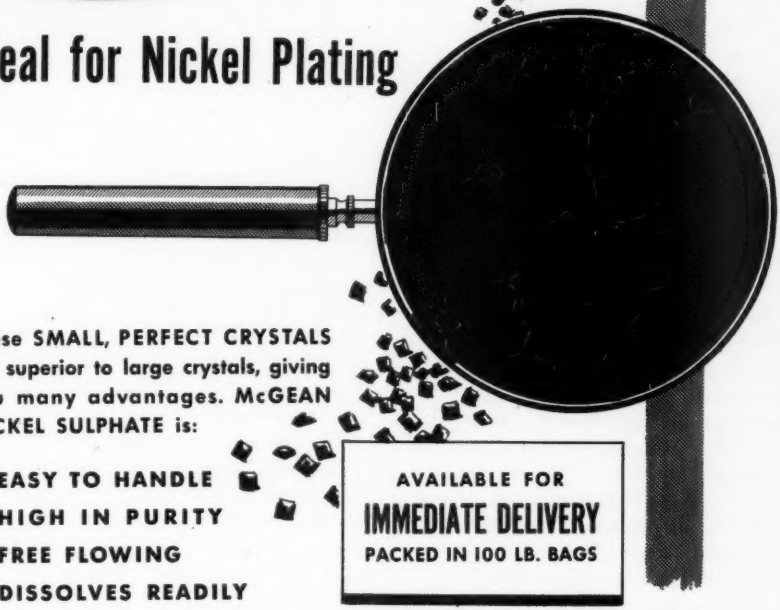
President.

"Tops"



McGEAN NICKEL SULPHATE

Ideal for Nickel Plating



These SMALL, PERFECT CRYSTALS are superior to large crystals, giving you many advantages. McGEAN NICKEL SULPHATE is:

- EASY TO HANDLE
- HIGH IN PURITY
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- DISSOLVES READILY

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BLISTERING OF CADMIUM PLATE ON SOLDERED STEEL

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Sylvania Electric Products Company, Engineering Research Department, Sylvania Center, Bayside, N. Y.

Summary

Blistering of electrodeposited coatings has generally been attributed to faulty plating techniques. A new type of blistering is described which is due to alloy formation between the electrodeposited metal and the base metal. In the case of cadmium coatings over steel which have been soldered with lead-tin solder, the area of blistering is observed to spread from the soldered joint at temperatures above 150°C. The magnitude of spreading of the blistered area is shown to be a function of the cadmium plate thickness and of the duration of the heating.

Introduction

Blisters in electrodeposited coatings are occasionally observed and are usually attributed to improper preparation of the base metal prior to plating, the presence of impurities in the plating solution, or the release from the base metal of gas which cannot readily diffuse through the plated metal. While composite metals present a more difficult problem of preparation prior to plating than a single metal, a satisfactory method generally can be worked out which will give sound, adherent deposits. The incidence of blistering in production plating is consequently regarded as a failure of the plating department to follow specifications and sound operating practice. In fact, this belief is so frequently encountered that it appears that another cause of blistering, alloy formation between the deposit and the base metal, has not received anywhere near the recognition it deserves.

From a simple physical point of view, the alloying of metals may occur in three general modes:

1. Solid solution formation
2. Compound formation
3. Eutectic formation

The first mode, by which such familiar processes take place as the diffusion of indium into lead, the solution of chromium in iron, and the solution of copper in nickel, will be omitted from the discussion since no blistering is encountered which is due wholly to such alloying. In fact, the usual result of solid-solution type alloying is the strengthening of the bond between deposit and base metal.

The second mode, compound formation, occurs frequently; examples are alloying of zinc with iron and of zinc with nickel. The former is usually not desired because brittle intermetallic compounds are formed which reduce the ductility of the coating[1] and, at high temperatures, may even cause tensile failure of the base metal[2]. In the latter a desirable corrosion resistant gamma phase may be formed under proper conditions[3,4]. In general the formation of compounds is not associated with blistering but with cracking of alloy layers subjected to deformation.

The third mode, eutectic formation, is responsible for the type of blistering problem considered here. Contrasted with other modes of alloying, it is characterized by substantial lowering of liquidus tempera-

ture, *i.e.*, the lowest temperature at which a liquid phase exists in a system at equilibrium. In the case of the so-called soft metals, cadmium, zinc, tin, and lead, the melting points of which are relatively low for a metal, the formation of a ternary eutectic results in a liquidus temperature sufficiently low to be a source of blistering when ambient temperatures are above 150° C (302°F).

Fig. 1. Blistered area 20 mm from soldered joint on steel part, cadmium plated and heated to 150°C for 1 hour. 14X

Fig. 1 shows the magnified appearance of this type of blisters that developed after heating to 150°C for one hour a cadmium-plated steel part which had a soldered joint at a distance of 20 mm from the spot shown. The fact that the entire surface of the piece (40 x 30 mm), except for the area immediately over the solder joint, was covered with blisters resulted in some confusion before the actual cause was identified.

Referring to Table I it is seen that this part had been heated to some 5°C above the ternary lead-tin-cadmium eutectic point.

TABLE I
Melting Points of Eutectics

System	Eutectic Point Temperature, °C.
Cadmium-Lead[7]	249
Cadmium-Tin[7]	176
Cadmium-Zinc[7]	263
Lead-Tin[7]	181
Lead-Zinc[14]	318
Tin-Zinc[14]	199
Cadmium-Lead-Tin	145
Lead-Tin-Zinc[15]	167
Cadmium-Lead-Tin-Zinc[7]	136

This particular eutectic formation was found to be responsible for the blistering in the experiments to be described. It should be stated that this type of blistering has been observed only over ferrous-base materials and not over brass. However, any advantage which might be gained from the substitution of brass for steel is lost in another way, since cadmium-plating over brass has its own peculiar incompatibility, that of whisker formation, which has been discussed elsewhere[5].

The alloys of the soft metals have been studied by Stoffel[6] and Swartz[7] from a metallurgical point of view and by Budgen[8] and Burgess and Woodward[9] from the standpoint of their use as solders. Mention of the fact that changes in structure may take place due to alloying between soft metal deposits and brass metals is made by Pfanhauser[10] but the role of this alloying in blister formation has apparently been generally overlooked.

Experimental

For this investigation samples were prepared under the following conditions:

Base Metal:

Experiments I–IV, VI

Cold rolled SAE 1010 steel, ¼ hard temper, prime finish

Experiment V

Yellow brass ,dead soft temper, polished

Cleaning:

1. Brush with a 1 : 1 mixture of pumice and tertiary sodium phosphate.
2. Electroclean as indicated in the experiment in a 2 oz/gal solution of a mixture of 60 per cent trisodium phosphate, 30 per cent sodium carbonate and 10 per cent caustic soda at 92° C (188°F) and 300 asf.
3. Spray Rinse.
4. Acid dip in 2 per cent hydrochloric acid at room temperature.
5. Spray Rinse.

Plating:

Solution*

Cadmium as metal.....4.5 oz/gal

Total Sodium Cyanide.....17.5 oz/gal

**Cadalyte*, a proprietary solution of E. I. duPont de Nemours & Company.

Ratio $\frac{\text{Total NaCN}}{\text{Cd}}$	3.9
Sodium Hydroxide	3.2 oz/gal
Brightener**	0.75 oz/gal
Current Density	36 asf
Temperature	35°C

The solution was filtered through No. 52 Whatman filter paper.

Agitation was produced by means of a glass propeller in front of the panel. A plating rack was used to obtain a very uniform deposit thickness over the panel surface.

A plating thickness of 0.0006 inch was applied unless otherwise noted.

After plating, the samples were rinsed, wiped dry with a jet of clean air and placed in an oven at 150°C (302°F). The samples were inspected after 10 minutes and after one hour at which time they were removed.

Soldering:

The samples for the determination of the effect of solders had been prepared with a spot of the solder on one face. A flux consisting of 600 g zinc chloride, 200 g ammonium chloride in 1000cc of water was used liberally and heating was accomplished by means of a reducing gas-oxygen flame from a hand torch. Heating was curtailed as soon as the solder was observed to wet the steel.

EXPERIMENT I

Effect of Cleaning of Steel

The appearance of the blisters as shown in Fig. 1 gave the impression that the cause might actually be release of gas from the base metal. To test this hypothesis the surfaces of five steel panels were prepared according to the standard cycle set forth above with the following variations:

Sample 1. Cathodic cleaning for 10 seconds

Sample 2. Anodic cleaning for 10 seconds

Sample 3. Cathodic cleaning for 50 seconds followed by anodic cleaning for 10 seconds

Sample 4. Anodic cleaning for 50 seconds followed by cathodic cleaning for 10 seconds

Sample 5. Cathodic cleaning for 3 minutes followed by a quick rinse and a 10 second dip in 50 per cent hydrochloric acid at 90°C (194°F) in place of cold 2 per cent acid.

There was no evidence of blistering on Samples 1–5 after heating in air. Should the blistering be due solely to the inclusion of gas during cleaning or plating, extensive blistering should have been detected. Since even Sample 5 was not blistered although it had been subjected to conditions conducive to hydrogen loading of the metal, one must conclude that gas alone is not responsible for the blistering observed.

EXPERIMENT II

Cadmium Plating over Lead-Tin Solder

Having eliminated the possibility of the blistering being caused exclusively by gas, sample steel panels were prepared with a central drop of solder to simulate the combination of metals of the article of Fig. 1. These panels were then cleaned, Sample 6 anodically and Samples 7 and 8 cathodically, plated with the standard 0.0006 inch thickness of cadmium, and heated in air to 150°C (302°F).

No difference was noted in the appearance of the three samples. Fig. 2 shows the appearance of Sample 8 at four different stages. Fig. 2a is a photograph taken before heating with the solder spot about 1 cm in diameter. After 10 minutes of heating at 150°C (Fig. 2b) there was a striking change in appearance in the vicinity of the solder spot: the surface to a distance of approximately 5 mm beyond the solder spot had become discolored and blistered. After one hour at 150°C (Fig. 2c) the discolored area had spread to approximately 1 cm around the solder spot and the blistering had become pronounced. The heating was continued for 24 hours (Fig. 2d) after which the blistering was observed to extend a distance of 52 mm to a remote edge of the specimen.

It is interesting to note the persistence of major structural landmarks in Figs. 2b, 2c and 2d. The large, elongated blisters radiating from the sunken plateau around the solder spot can be observed in all three. The blisters directly over the solder spot are very brittle in comparison with the blisters over the steel; the latter may be smoothed

****Cadalyte Brightener**

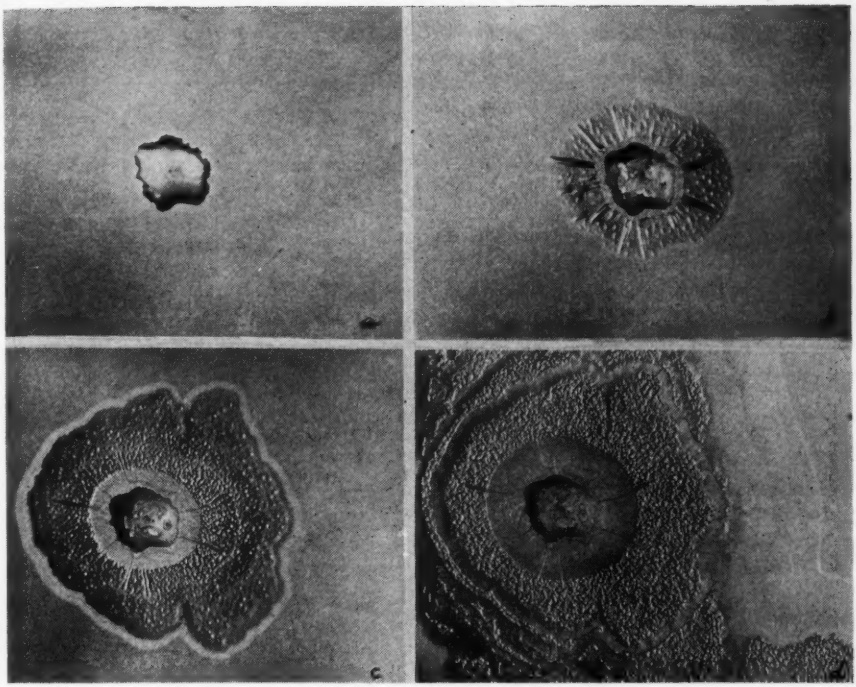

Fig. 2. Steel specimen with solder spot, after cadmium plating: (a) before heating, (b) after heating for 10 minutes at 150°C, (c) after heating for 1 hour at 150°C, (d) after heating for 24 hours at 150°C. 1.8X reduced to 0.9X

out by a slight burnishing action. Initially, the blisters over the solder stand out clearly and the surface is bright, but as heating is continued the blisters are absorbed into the solder spot and the general appearance becomes quite dull. Two separate unblistered areas may be noted. The first, already referred to, is the sunken plateau adjacent to the solder spot. The second is an outermost area which is well defined in Fig. 2c; it appears as a milky band in contrast with the bright cadmium surface.

Fig. 3. Enlarged view of blisters in Fig. 2d. 60X reduced to 30X

Fig. 3 shows the magnified appearance of the blisters in Fig. 2d. Comparison of the original blisters in Fig. 1 with those in Fig. 3 shows only one major difference: the cracks found in the original blisters are not present in the latter. It can be supposed that impurities or gas have been coincidentally present in the original case and to have altered the appearance. Subsequent experiment (VI) tends to confirm this hypothesis. No apparent difference was noted between the appearance of the anodically and cathodically cleaned specimens.

EXPERIMENT III

Single Metal Solders

In order to study the effect on binary metal

combinations, two samples were prepared with each of the following metals soldered to steel by the same technique as was used in the preparation of the samples in Experiment II and described previously under Experimental. The zinc ammonium chloride flux gave good wetting of the steel by each of the methods at temperatures slightly above their melting points. One sample was subjected to anodic cleaning and the other to cathodic cleaning.

	Cleaning	
	Anodic	*Cathodic*
Lead.....	Sample 9	Sample 10
Tin.....	Sample 11	Sample 12
Zinc.....	Sample 13	Sample 14
Cadmium...	Sample 15	Sample 16

No blistering was observed on Samples 9 to 16 after heating in air. This is to be expected, since the temperature of heating was much lower than any of the eutectic points and consequently no appreciable amount of alloying would be expected.

EXPERIMENT IV

Effect of Cadmium Thickness

In adjusting the plating conditions for the preparation of Samples 6, 7 and 8 to obtain the standard cadmium thickness of 0.0006 inch, it was noticed that the extent of blistering was a function of the plate thickness. A series of steel panels with solder spots was cadmium plated to study this factor; the plate thicknesses are given in the second column of Table II, and the spread of discoloration and the blistering resulting from heating at 150°C for one hour is given in the third column.

After heating, blistering was observed directly over the solder in all cases. Samples 17–22 did not exhibit any blistering other than on the solder and only a slight discoloration, which may be considered evidence of alloying on heating, to distances which varied between 0.5 and 2mm from the solder spot depending upon the cadmium thickness. Samples 23–27 showed extensive blistering remote from the solder spot. The area of blistering appeared to increase with the plate thickness until the latter was approximately 0.0008 inch; with heavier coatings the blistered area decreased in size, although individual blisters became very large. This effect of deposit thickness pointed to an explanation of the lack of blistering on testing of certain competitive samples. Examination showed these deposits to be less than 0.0002 inch thick. Tests of cadmium deposits between 0.0005 and 0.0008 inch invariably showed 100 per cent blistering.

TABLE II
Effect of Cadmium Plate Thickness on Steel on Spreading of Discoloration

Sample No.	Cadmium Thickness* Inch	Distance of Spreading** mm
17	0.00010	½
18	0.00017	1
19	0.00022	1
20	0.00028	1½
21	0.00034	1½
22	0.00045	2
23	0.00056	8
24	0.00060	6
25	0.00065	7
26	0.00083	11
27	0.00084	10
28	0.00093	8
29	0.00095	7
30	0.00110	6
31	0.00200	6

*By Magna-Gage[11]
**Spread of discoloration and blistering from edge of solder spot

EXPERIMENT V

Effect of Plating on Brass

Among the first observations made in the course of the investigation was the lack of blistering of cadmium on brass. As previously mentioned, plating of cadmium over brass is usually undesirable in the radio

TABLE III
Effect of Cadmium Plate Thickness on Brass on Spreading of Discoloration

Sample No.	Cadmium Thickness* Inch	Distance of Spreading** mm
32	0.00012	2
33	0.00022	2
34	0.00038	1
35	0.00089	½

*By Hull & Strausser Method[12]
**Spread of discoloration from edge of solder spot

industry because of the possibility of whisker formation[5], although favorable service conditions may occasionally permit its use. As an aid to the understanding of this phenomenon, a series of specimens was prepared with lead-tin solder spots on yellow brass, cathodically cleaned, and cadmium plated.

Blistering was observed on Samples 32–35 (Table III) only directly over the solder. All samples showed only slight evidence of spreading of discoloration, although the thin coatings showed the greatest spread. The size of the blisters increased with plate thickness.

EXPERIMENT VI

Effect of Storage in Plating Tank Prior to Plating

During preparation of samples for this investigation, it was noted that marked discoloration occurred in the vicinity of the solder spots at the start of plating. This effect was prevented by making cathodic contact to the panel before immersion in the plating solution so that electroplating started immediately upon introduction of the panel into the bath.

In order to ascertain the extent to which this smutting would contribute to blistering, samples were deliberately stored in the plating bath for various lengths of time prior to plating, Sample 36 for 5 minutes and Sample 37 for 20 minutes.

Some tendency for preferential blistering of the smutted areas was observed. On Sample 37 the blistering appeared to follow streaks below the solder spot for a distance of 16 mm. On Sample 36 the blistering was apparently random; both simulated to a greater degree the appearance of the blistering observed on condensers. The occurrence of cracks in the blisters was only a fraction of that encountered on the part in Fig. 1, but this might have been due to the milder cleaning technique used in preparing Samples 36 and 37.

Discussion

The new type of blistering described in Experiments I, II and III has been shown to be the result of the formation of a liquid phase of a ternary alloy of lead-tin-cadmium which spreads over steel with the coincidental production of blisters. These blisters, occurring as they do well beyond the source, may not at first be recognized. This is particularly true where other disturbing factors exist such as smut from storage of the part in the tank prior to plating, residues from overpickling or cleaning, lead contamination of the electrolytic baths, and gas in the base metal.

The dependency of this blistering phenomenon upon plate thickness has yet to be explained in a satisfactory manner. It is unfortunate that the thickness for maximum spread lies so close to the usual recommended thickness of 0.0005 inch for ASTM type NS coatings[13]. It was most disconcerting, early in the investigation, to find that thin cadmium coatings produced by other platers in poorly controlled and even dirty solutions would pass the blistering test. The discovery of the effect of thickness did much to bolster confidence in the value of careful, close control of the plating processes.

The actual structure of the coating in the different areas on or around the solder spot is under further study as is the matter of the lack of spreading of the blistering over brass. A possible explanation for the latter may be that intermetallic compounds are readily formed between soft metals and brass but are not readily formed at these temperatures between the soft metals and ferrous base metals; intermetallic compounds having by nature high melting points would not flow at these temperatures.

This paper has been limited to the study of the cadmium-tin-lead system. Another system which would be expected to give a similar type of blistering is the zinc-tin-lead system. Alloy formation has been observed in zinc coatings over solder spots at temperatures above the eutectic temperature of 167°F. However, to date no formation or spreading of blisters has been found on zinc plated samples prepared in a manner similar to the cadmium plated samples.

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Annual N.A.M.F. Meeting in Detroit

The Annual Meeting of the National Association of Metal Finishers, Inc., was held on June 25 in Detroit in conjunction with the A. E. S. Convention. Jobbing and contract platers from all parts of the United States and Canada as well as a visitor from England were present.

The new President, Mr. C. R. Crawford of Chicago, welcomed the members, and a vote of thanks was extended to the retiring president, Mr. E. J. Musick of St. Louis.

Reports were then made by Executive Secretary Raymond M. Shock, retiring Treasurer Henry J. Bock of Detroit, Finance Committee Chairman R. A. Campisi of Boston. Others reporting were Mr. Harold E. Coombes of Pasadena, Cal., on membership; Mr. Philip Sievering, Jr., of New York City on labor, Mr. George Harding of Detroit on trade relations, and Mr. Colgate Gilbert of New Hampshire on by-laws. The latter were amended to permit admittance as Class B members of individual firms in areas having no local member associations.

During the past year surveys have been made of the plating industry in Detroit and Chicago, and scarce materials were obtained for platers through the Small Business Division of U. S. Department of Commerce.

Future projects include the publication of a job-platers' manual and a monthly news bulletin, and setting up a labor relation counciling service and a group insurance and hospitalization plan for the industry.

The new Officers of the Association are:

President—C. R. Crawford, Chicago

First Vice-President—R. A. Campisi, Boston

Second Vice-President—H. E. Coombes of Pasadena

Third Vice-President—Mr. Egan, New Orleans

Job Shop Operations

The Masters Electroplating Association, 123 William Street, New York 7, N. Y., in its *Monthly Bulletin* for June advises that the rate of operation among its members was 52½ per cent during June, 1947 against 57½ per cent during May, 1947 and 80 per cent during June, 1946.

Pinner to Attend International Conference

"Walter L. Pinner, Past President of the American Electroplaters' Society, Manager of Research & Development for the Houdaille-Hershey Corporation, Detroit, Mich., will attend the Third International Conference on Electrodeposition to be held September 17–20 at the Hyde Park Hotel in London."

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CHEMICAL FINISHING OF METALS

F. P. HEARD, A. A. C. I., A. M. T. C.

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INTRODUCTION

Along with most other fields of engineering, chemical finishing has seen its share of advancement during the war particularly in its application to weapons requiring protection where other finishes, such as plating or painting, are not applicable or even desirable. While its field in peacetime production may be seen to diminish slightly, it can still play its part not only in the battle against corrosion but also in producing a pleasing, salable and durable finish.

Chemical finishing means the conversion of the surface layer of a metal article from its metallic state to a chemical compound of that metal by chemical means. By far the most common reaction of this nature is conversion to an oxide, while phosphate coatings are extensively used, particularly on ferrous metals.

It is proposed in this paper to limit detailed discussion to those processes with which the writer has had practical experience. A number of other processes, which are probably quite satisfactory, will be mentioned as of passing interest.

OXIDE COATINGS ON FERROUS METALS

The most prominent method of obtaining black oxide coatings on ferrous metals over the past few years has been treatment in highly concentrated alkaline solutions at temperatures in the vicinity of 300° F.

It is believed that the three main essentials to the process are (a) source of oxygen, (b) high *p*H, and (c) active contact between the chemical solution and the steel surface.

In the early development of the process, solutions consisted merely of about 5 pounds per gallon* of sodium hydroxide, NaOH, and it was believed that the water was the source of oxygen.

Considerable improvement was obtained by the addition of oxidizing agents, such as sodium or potassium nitrate, sodium or potassium nitrite, sodium or potassium chromate, potassium permanganate, chromic acid, manganese dioxide and lead oxide, to mention only some[1]. Addition agents for other purposes, known to have been used, are urea which definitely accelerates the reaction, at least halving the time, and sodium acetate which possibly acts as a buffer; but solutions containing these compounds are so difficult to control that their use is not warranted.

The high *p*H is furnished by the high concentration of alkali while the vigorous boil-

*The gallon referred to in this article is probably the British Imperial gallon which equals about 1.2 U. S. gallons.

1 lb/Imp. gal = 0.83 lb/U. S. gal.

ing of the solution provides the necessary intimate contact with the work.

The chemical reactions involved in the process are rather obscure, but it would appear that the caustic soda has, at the temperature used, a slight solvent action on the iron forming sodium ferrite or sodium ferrate or both, and that this compound is then converted to ferrous ferric oxide, Fe_3O_4, commonly known as magnetic oxide or magnetite. This compound is usually jet black, but it has been found possible to produce a range of colors from jet black through blue-black to brown and brown-red. Various factors affect the color, the most effective of which is boiling temperature and concentration. These two factors are grouped together because the one is dependent entirely upon the other. It is well known that when a soluble salt, in this case caustic soda and the oxidizing agent, is dissolved in water, the boiling point of the solution is raised. The jet black and blue black colors are produced within the range 280° to 320° F. As the temperature is increased further, the brown and brown-red colors appear. However, as the writer's experience has always been in the production of blacks with every care taken to prevent the formation of browns, no information can be given on the technique of producing the latter purposely. Their formation, when to the best of our knowledge all operating conditions have been perfect for blacks, has at times been very disconcerting.

These failures in most cases can be attributed to variations in type, prior heat treatment or surface condition of the steel. The more highly polished the steel, the better the result provided the surface has not been too severely cold worked. Bright rolled steel with its cold worked surface frequently gives trouble, mainly in extending the time required to produce a satisfactory thickness of coating. It has been stated in the literature that chromium steels cannot be processed, but the writer has had no serious trouble with steels containing up to 4 per cent chromium. A little difficulty was, at first, met in blackening jungle machetes made from 1 per cent chromium, 0.2 per cent zirconium steel. These blades are hand ground almost to size, then heat treated by a process known as austempering, hand polished and sharpened, and finally blackened. Unfortunately, a slight amount of surface decarburization cannot be avoided during austempering and, if this low carbon skin is not entirely removed by the subsequent polishing, brown areas result where the blade has been insufficiently polished. More care during polishing soon overcame the trouble. Brown colors on steels containing tungsten cannot be completely eradicated, probably due to the formation of tungstic oxide, WO_3, which in its pure form is yellow.

On one occasion when a batch of small flat springs were very brittle after treatment, caustic embrittlement was immediately suspected. A series of exhaustive tests were then carried out which showed that during the first half hour of immersion very slight embrittlement took place, but as the time was extended to as much as 24 hours, no further embrittlement could be detected. The total effect is so small as to be negligible, and the condition could not be reproduced.

Preparation

Preparation consists of cleaning by the usual methods in vapor degreasers or hot alkali cleaners with or without current, with shot or sand blasting, sand tumbling or pickling; any combination of the above being used according to the condition of the metal surface and the requirements of the subsequent finish. The work may be strung on wires or placed in baskets or on racks. Brass, copper, galvanized or zinc lined containers must not be used as they contaminate the solution with subsequent deposition of these metals on the work.

Processing

Immediately after preparation, the work is immersed in the processing bath. The tank is of welded mild steel and may be heated by steam, gas, or electricity, steam being decidedly preferred with heating coils of steel tubing.

The preferred salt is a mixture containing 70 per cent sodium hydroxide and 30

per cent sodium nitrate, the two constituents having been fused together and cast into moulds producing lumps about 2 inch square by about 3 inch long. This is the best form in which to obtain the salts as it facilitates additions to the bath while in operation. In starting a new bath, about six inches of water is placed in the tank and heated to boiling. The salt, in successive quantities of about 20 pounds at a time, is then placed in a basket and suspended in the boiling solution until dissolved. As this volume of solution reaches the desired operating temperature, water and salt are further added until the desired volume and temperature is obtained. The solution will then contain about 10 pounds of salt per gallon.

Great care should be taken in adding water as the resultant local super-heating at the point of contact between water and solution may cause a boil-over. If automatic temperature-concentration control is provided, this problem is greatly simplified; otherwise the water should be added in a slow, continuous flow down the side of the tank. The automatic control consists of a bulb type temperature-indicating controller operating a motorized valve in the water line through an on-off relay. As the solution evaporates and becomes more concentrated, the boiling point rises above the control temperature and the signal from the controller causes the motorized water valve to open whereby water is added to the solution. When sufficient water has been added to bring the boiling point below the control temperature, the controller signal causes the valve to close. In normal operation of a tank 40 x 24 x 24 inch deep, the time for water addition should be approximately one-half hour, shorter time being likely to cause boil-over and longer time being inconvenient and unnecessary. If automatic control is not provided, it is advisable to adjust the water addition to a continuous flow just sufficient to make up evaporation losses.

A good coating is not usually obtained immediately a new bath is made up, a condition familiar to platers with new plating baths. The difficulty is overcome in the same way, by processing scrap metal for a day or two until good results are obtained.

Processing may be carried out by either a single or a two-bath treatment, the former consisting of about 30 minutes at 290° to 300° F and the latter of about 15 minutes at 290° F followed by 15 to 30 minutes at 315° F. Experiment has shown that two-bath treatment definitely gives better protection and wear resistance than the single-bath treatment.

Maintenance of the bath is relatively simple. Drag-out losses should be replenished daily, a bath of the above dimensions requiring about 10 to 20 pounds of salt per 8 hour shift. Occasionally straight caustic soda is added instead of the mixed salts in order to suppress the tendency to produce brown coatings. The brown sludge which forms at the bottom of the bath should be removed about every 80 to 100 hours of operation.

Adequate goggles, gloves and apron should be worn by the operator, and the tanks should be provided with exhaust ducts or hoods or removable lids because splashes or spray from the solution are very injurious. An overhead monorail hoist is recommended for ease of handling.

Finishing

After removal from the processing tank, the work must be thoroughly washed in cold running water, dried, and sealed in some way such as by painting, lacquering, waxing or oiling. Dipping in hot soluble oil is an excellent, cheap finish.

The thickness of coatings developed by this and similar processes has been variously quoted by suppliers of proprietary salts at from 0.00003 to 0.00004 inch. On the few occasions that the writer has measured them, he has found them to be from 0.00004 to 0.00006 inch. This does not mean that the original dimensions of the part are increased by this amount; on the contrary, the actual dimensional increase is appreciably less because the iron for the formation of the iron oxide coating must come from the parent metal, which, in effect, means that a small thickness of iron on the surface of the part is converted into a larger thickness of iron oxide.

Good protection against corrosion and wear as well as good appearance and adhesion are obtained, and the coating can be used as a base for paint or lacquer. Under severe tropical conditions, however, tests have proved oxide coatings very considerably inferior to phosphate coatings. Their ability to hold lubricants and their low coefficient of friction have found oxide coatings a use on bearing surfaces, particularly during the early "running in" stages, but claims of improved tool life have not been substantiated by practical results. Various types of lathe tools, milling cutters, etc., both in carbon and high speed tool steels, have been tried without noticeable improvement.

Summing up, the process is rapid, simple to apply and control, relatively cheap and should find a number of uses in peacetime finishing.

OTHER PROCESSES FOR STEEL

Prior to the development of the alkali nitrate solutions, a number of methods were in use and in many cases still are. The simplest and probably oldest of these is straight-out heating to various temperatures which gives the various colors shown in Table I. The temperatures are only approximate because many variables such as time, condition of the surface, type of steel, and medium surrounding the work affect the color.

TABLE I

Interference Color on Steel

Temperature		Color
°F	°C	
428	220	Pale yellow
464	240	Straw yellow
491	255	Brown yellow
536	280	Purple
554	290	Pale blue
599	315	Dark blue

Investigation into the effect of the medium surrounding the work led to the use of charcoal, molten lead, sand, and molten salts. Improved results were then obtained by heating to a pre-determined temperature in the vicinity of 1000° F (538° C) and quenching in various types of oil.

Very attractive and durable finishes have been produced for many years by heating to about 700° F in revolving retorts containing mixtures of carbonaceous materials such as cork, charred bone, bone oil and sperm oil.

A method frequently used in recent years is immersion in a molten salt mixture containing equal parts of sodium and potassium nitrates, known as the niter bath. This mixture melts at approximately 430° F and is operated at from 600° to 650° F, the articles being first coated with a thin film of oil. Improved results can be obtained by adding about 2 per cent of manganese dioxide and heating the bath to about 900° F before use This causes iron and other impurities to precipitate and form a sludge on the bottom. A serious disadvantage with all these methods is the high temperature of operation which can cause distortion of parts pressed or drawn from cold rolled sheet steel and can destroy the effect of prior heat treatment.

Solutions containing chlorides of bismuth, mercury, copper, iron, and antimony and various organic materials have been used for many years, especially by gunsmiths, and produce very excellent finishes, but unfortunately they are very tedious and time consuming. A typical example of these solutions is as follows:

Ferric chloride (cryst.), $FeCl_3.6H_2O$ 4 lb/gal
Antimony trichloride, $SbCl_3$ . . . . . 4 lb/gal
Gallic acid, $C_6H_2(OH)_3COOH$ . . . . . 1 lb/gal

The work is dipped into or swabbed with the solution and then allowed to rust. Rusting may be carried out at room temperature or accelerated in hot, high humidity ovens. The rust film is then rubbed down and the process repeated till the desired color is obtained.

BLACK OXIDE COATINGS ON COPPER ALLOYS

Methods for coloring copper alloys are numerous and varied, but it is proposed here to deal with only two, both of which produce a black finish. The first is anodic treatment in a sodium hydroxide solution[2] and the

second treatment in a boiling solution of sodium hydroxide and sodium chlorite.

The anodic process was developed when it was found impossible to obtain adequate adhesion and wear resistance by means of ammoniacal copper carbonate and similar solutions. The solution is simply 15 per cent sodium hydroxide (1½ pounds per gallon), and its concentration does not appear to be very critical. The writer has operated it satisfactorily as low as 13 per cent, but no attempt has been made to determine its limits. The most essential points are constant temperature, 80° C ± 3° C, and constant current density, 5 to 9 asf. During the first minute of electrolysis, the current and voltage remain constant and there is no evolution of gas from the anode. Evolution of gas then begins, and considerable electrode polarization is developed necessitating a gradual increase of the voltage until a satisfactory coating is obtained in from 5 to 7 minutes total time. One must use as large a cathode area as possible with the ratio of cathode area to anode area at least 8/1 which is usually readily obtained by making the iron tank itself the cathode. While copper alloys, such as yellow brass, red brass, and bronze, can be blackened quite well, much more consistent results can be obtained by flash copper plating first. On removal from the vat and after thorough washing, the work has an excellent non-reflecting black finish with a velvety appearance. If it is desired to retain the dull velvety appearance, the work is immediately dipped in a thin clear lacquer or a very dilute black lacquer. If a bright glossy appearance is desired, light rubbing followed by waxing or lacquering produces a very attractive adherent finish. The parts may be handled on wires or racks, but it is doubtful whether barrelling would be satisfactory owing to the critical requirements of temperature and current density control, and cathode area. A slight health hazard exists in the fine caustic spray which accompanies the evolution of gas from the electrodes, but may be overcome by a removable cover or an exhaust system.

The boiling alkali chlorite process was developed in America during the war and is not well known in this country. The principle involved is very similar to that of the alkali nitrate process for steel in that a hot alkaline solution containing a strong oxidizing agent is used, but temperature and concentration is very much lower and a very much more active oxidizing agent is required. The solution composition is as follows:

Sodium hydroxide, NaOH . . . 20 oz/gal
Sodium chlorite, $NaClO_2$ . . . . . 5 oz/gal

The solution is operated at or just under the boiling point, no current is required, and an excellent wear resistant and adherent black similiar in appearance to and more durable than that obtained by the anodic process is obtained in 5 to 10 minutes. The parts may be handled on wires or racks or in baskets, and the solution may be contained in mild steel tanks. As the quality of the finish deteriorates with use of the bath, this is replenished by addition of either chlorite or the mixture of caustic and chlorite. Eventually the copper content becomes excessive, the bath has to be discarded, and a new one made up. Unfortunately, sodium chlorite is not obtainable in this country and proprietary salt mixtures have to be imported. While the manufacturers of these mixtures claim the cost of materials at 1 cent per square foot of surface area in America, importation brings the cost to about 4 cents per square foot in this country. Experiment has shown that one pound of the salt mixture containing 80 per cent caustic soda and 20 per cent $NaClO_2$ will blacken approximately 15 square feet of surface area. Since a slight odor of chlorine is detectable over the solution when hot, some exhaust system may be necessary in a large scale set-up.

PHOSPHATE COATINGS ON FERROUS METALS

A very brief discussion of the history of phosphate coatings is interesting. Although the first significant commercial application of phosphate coatings was introduced by Coslett in 1908[3], there is evidence that they were used for protection of iron articles by the Romans as early as the third century A. D. Metal parts of women's corsets were

treated with phosphoric acid in 1869. Coslett's process employed a solution of phosphoric acid and ferrous sulfate and later phosphoric acid and zinc sulfate. Between 1915 and 1918 the Parker Rust-Proof Company in U. S. A. developed its "Parkerizing" process by the addition of manganese dioxide which, it was claimed, oxidized the phosphate to ferric phosphate. The most important advancement was made in 1926 when the use of manganese dihydrogen phosphate reduced the processing time from several hours to half an hour. It is this solution, buffered, it is believed, with boric acid, which today produces the best known chemical protection of steel. That is not meant as applying purely to the Parker process as a number of other proprietary salts are now coming on the market. Since 1930, various accelerators such as copper salts and nitrates have been used bringing about still further reductions in the time required to produce a satisfactory base for paint, but these coatings are not so protective as the non-accelerated coating. The chief advantage, and an exceedingly useful one, of the use of accelerators is in the reduction of time to less than one minute. This enables continuous conveyor-type handling through a series of chambers where the hot solutions for cleaning and processing are sprayed onto the work and then through a drying chamber to final finishing. Large installations of this type are well known in the automobile and other similar industries.

Preparation

Preparatory treatment for phosphating is far more important than is generally realized, particularly when material other than mild steel is being treated. In addition to being dependent on the type of steel being treated, preparation is also governed by the ultimate object of the finish, i. e., whether it is to be further protected by a paint or lacquer or the coating itself is to provide the protection.

Where ordinary machine or bright rolled mild steel is concerned and the coating is to serve as a base for paint and the part is to serve only in temperate climatic conditions, the normal methods of vapor or alkali degreasing is quite sufficient.

Many problems arise, however, when the phosphate coating itself is to provide the maximum possible protection to steels of different analyses in a variety of conditions of heat treatment as has been the case during the war years in finishing the component parts of machine guns and rifles. Apart from providing maximum protection, the coating had also to be non-reflecting, a property gained mostly by sandblasting. As experience was gained, however, it became evident that the sandblasting played a much more important role than merely providing non-reflectivity because the disturbance thus brought about on the surface of the steel provided by far the best preparation for the coating, its function being, it is believed, something more than merely that of cleaning. In the finishing of magazine cases pressed from bright rolled steel, the procedure is to vapor degrease, sandblast, and then phosphate. While only light sandblasting would fulfill the requirements of non-reflectivity, rather heavy blasting causing considerable disruption of the cold worked bright surface is necessary in order that a coating with maximum corrosion protection be obtained. In many cases, however, sandblasting is not a practical proposition owing either to the ingress of sand to recessed holes or warpage or some such condition, and pickling in hot 10 per cent sulfuric acid to which has been added about 5 per cent of sodium sulfite is resorted to. Pickling, however, is the source of many troubles and is not recommended if sandblasting is at all applicable.

More recently, experiments have been carried out with hot phosphoric acid solutions of various concentrations as a pickle instead of sulfuric acid. Some very promising results have been obtained. Great care must be taken in controlling the temperature and concentration of the acid and the time of immersion. It so happens that most of the parts which the writer has had to pickle are made from an alloy steel containing 0.5 per cent carbon, 1.0 per cent chromium and 0.2 per cent vanadium or zirconium (SAE 6150) in a hardened and tempered condition. If the work is overpickled, the familiar pickle smut film is left

on the surface. This prevents adhesion of the ferric phosphate coating and permits continued phosphoric acid attack on the steel resulting in a smutty, burnt looking, non-adherent coating possessing very poor protective properties. The most troublesome alloying element met with is nickel, e. g., the 3.5 per cent nickel, 1.0 per cent chromium, 0.1 per cent carbon steel, whether in the carburized condition or not. In addition to requiring a more concentrated phosphate solution as will be seen later, these steels, particularly when carburized, require special care in preparation. The best procedure is to sandblast, acid pickle for only sufficient time, about 4 to 8 seconds, to allow hydrogen bubbles to form, thoroughly rinse in hot water, and immediately immerse in the phosphating solution. Good results can be obtained by sandblasting only, but more consistent results are brought about by utilizing the light pickle.

While on the subject of preparation, it will be well to mention the use of stop-off lacquers. Many parts possess ground or lapped surfaces on which a phosphate coating is forbidden for various reasons. These surfaces are easily protected by the use of stop-off lacquers. The usual platers' stop-off lacquers are excellent for the purpose and, in fact, are better than necessary. Cheaper, fast air-drying synthetics of the alkyd type are quite satisfactory.

Processing

The processing solution is contained in a mild steel tank and may be heated by gas, electricity, or steam; again, as in the alkali nitrate oxidizing solution, steam is definitely preferred. Steam heating coils should be of copper tubing and placed on one side of the tank. The solution contains approximately 4 ounces of prepared salts per gallon. Its strength is controlled by titration of a 10 ml sample with 0.1 N NaOH using phenolphthalein indicator, a test simply and easily carried out by any operator and really a determination of the total phosphate present. The NaOH titre is normally controlled at 30 ml making what is known as a 30 point solution. The ratio of total phosphate to free phosphoric acid can be determined by first titrating the sample with methyl red as indicator and then with phenolphthalein. It has been stated that this ratio should be between 4 and 7½ to 1. Having made frequent titrations on baths in production and never having found the ratio outside that range, the writer does not know what effect deviation from the range would have on bath performance.

The 30 point solution is almost universally used and will give good results with all except nickel steels. A 20 point solution containing accelerators is used when the coating is only to provide a paint base. For processing nickel steels, a solution titrating 45 to 50 points has been found necessary. The reason is somewhat obscure; it is probably associated with the fact that nickel in steel does not form the more readily etchable carbides but is dissolved in the ferrite where it retards the reaction with phosphoric acid.

The time of immersion varies considerably from as little as one minute to as much as one hour according to the solution used and the type and condition of the steel; e. g., low carbon steels take longer, particularly when cold rolled, than high carbon steels. The average is about 10 minutes for accelerated solutions and 30 minutes for non-accelerated solutions. As the work is immersed, a vigorous bubbling and evolution of hydrogen occurs which gradually subsides and eventually stops, thereby denoting completion of the reaction.

Temperature of operation is 208° to 210° F or just under the boiling point. It is definitely advantageous to control the temperature with a thermostat when operating at or near sea level. It is interesting to note, however, that Lithgow is approximately 3,000 feet above sea level so that the boiling point of the 30 point solution is always about 208° F thus eliminating the necessity for control, while the 50 point solution which boils at about 209° F gives better results when controlled down to about 206° to 207° F, higher temperature tending to produce a "burnt" appearance.

Finishing

On removal from the processing tank, the work is thoroughly rinsed in hot water

and sealed. Sealing is as important as the process itself for without it, little protection is obtained. It consists of oiling, waxing, or painting. Some people prefer a dilute chromic acid dip prior to application of the oil, wax or paint, and indeed, some munition specifications insist on a chromic acid dip. The standard seal for small arms is a mixture of 5 parts of a heavy semi-drying oil with one part of colloidal graphite, excess oil which remains after dipping being removed in a centrifuge.

Hydrogen Embrittlement

In view of the fact that some objection has been raised to the phosphating of articles such as springs because of hydrogen embrittlement, the inclusion here of some experimental data is relevant. The presence of hydrogen embrittlement in cadmium plated springs is well known to platers, but it is the writer's contention that by far the greater part of the embrittlement is not caused by the actual cadmium plating, or in this instance, the phosphating, but is really caused by preparatory pickling. The particular spring selected for test was 5/8 inch wide by 0.015 inch thick, formed to a zig-zag shape and then hardened and tempered. The normal finish was a matte black baking synthetic, a phosphate coating being disallowed. The method of testing consisted in the application of a transverse load, a low breaking load denoting a brittle spring. (EDITOR'S NOTE: DYNAMIC TESTS ARE BELIEVED TO BE SUPERIOR TO STATIC TESTS FOR EVALUATION OF EMBRITTLEMENT.) Approximately 100 tests were carried out under each set of conditions with results shown in Table II.

It is quite evident from the results that the pickle is the real offender. Incidentally, the real surprise came from the synthetic enamel finish which gave as low though not as erratic results as the pickling.

The effect of heating subsequent to phosphating is interesting. It brought about a slight improvement of the pickled springs but did not improve the unpickled springs, suggesting that some hydrogen embrittlement is definitely caused by pickling and phosphating but very little, if any, by phosphating only.

TABLE II

Embrittlement of Springs

Finishing Treatment	Average Breaking Load, Ton
Sprayed and baked synthetic lacquer	0.0165
Pickled, phosphated	0.018
Pickled, phosphated, tempered at 100° C	0.016
Pickled, phosphated, tempered at 150° C	0.018
Pickled, phosphated, tempered at 200° C	0.017
Pickled, phosphated, tempered at 250° C	0.020
Phosphated only	0.022
Phosphated, tempered at 100° C	0.022
Phosphated, tempered at 250° C	0.022
Pickled only	0.009-0.065

PHOSPHATE COATINGS ON NON-FERROUS METALS

Phosphate coatings on zinc and cadmium have been used for some years, the process being similar to that for ferrous metals. While their application to such metals as nickel, silver, aluminum and stainless steel has not yet been seen in this country, a number of proprietary salts which are believed to contain organic acid phosphates are coming on the market in U. S. A. We shall probably see more of these in this country in the near future.

ACKNOWLEDGMENT

The writer wishes to thank Mr. Finlay, Divisional Manager, Small Arms Factory, Lithgow, for permission to use the experimental data and much of the information included.

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Abstracts . . .

of Papers Presented at the 34th Annual A.E.S. Convention

(Concluded)

Stress in Electrodeposited Nickel, by W. M. Phillips and F. L. Clifton, General Motors Research Division, Detroit, Michigan.

This study was undertaken to increase the resistance of plated coatings to cracking in service. Hence internal stress by itself and in connection with assembly- and service-introduced stresses were studied. Particular attention was paid to the ductility of the coatings which largely controls the effect of stress.

New methods of determining and calculating stress are presented. An apparatus which gives relative values for ductility is shown.

It was demonstrated that hydrogen embrittlement affects ductility but not stress. Stress in copper is low, especially when deposited from acid baths. The effects of the following variables in nickel deposition were determined: *p*H, bath temperature, current density, plate thickness, contents of chloride, hydrogen peroxide, iron, and brighteners. Calculated stresses varied from 7,000 psi in compression to 65,000 psi in tension.

It is recommended that baths be chosen and operated to give deposits of low internal stress and high ductility. This means low *p*H, high temperature, high purity, and careful control of brighteners and other addition agents.

Manufacturing Process for Standard Sixty-Inch Reflectors, by Newell F. Blackburn, The Engineer Research and Development Laboratories, The Engineer Center, War Department, Fort Belvoir, Virginia.

After removal of protective coatings of black paint, copper and silver, the precisely ground glass master is rinsed, cleaned with rouge, rinsed, treated in stannous chloride solution, rinsed, silvered in ammoniacal silver nitrate-formaldehyde solution, racked wet with water, copper flashed in copper sulfate solution, rinsed, air dried, re-racked to close dimensions, stopped off, dried, copper plated with rotation in copper sulfate solution for three days, cleaned of nodules and returned for copper plating for four more days until 200 lbs have been deposited, rinsed, freed from stop-off, unracked, treated with polysulfide solution, and separated from the copper deposit by means of infra-red heat.

The positive mold thus formed is checked for optical accuracy, buffed with lime on a muslin wheel and with rouge on a flannel wheel, swabbed with alkali cleaner, rinsed, swabbed with lime solution, rinsed, treated with 10 per cent sulfuric acid, rinsed, treated with separating fluid, racked, nickel flashed, rinsed, copper flashed, rinsed, air dried, re-racked, stopped off, copper plated for five days with intermittent inspection and removal of nodules until 135 lbs copper have been deposited, freed from stop-off, treated with ammonia to neutralize entrapped solution, rinsed, unracked, and carefully separated from the thus formed reflector.

The latter is alkali cleaned, rinsed, air dried, checked for optical accuracy, buffed to dimension, racked, cleaned as the positive mold, nickel plated for one hour, rinsed, air dried, buffed, stopped off, dried, cleaned on specular surface, plated with 0.000001-2-inch rhodium, rouge colored, and tested.

Extraction Methods Applied to the Analysis of Electroplating Baths and Determination of Zinc and Other Impurities in Nickel Solutions (A.E.S. Research Project No. 2), by E. J. Serfass and W. S. Levine, Lehigh University, Bethlehem, Pa.

A summary is given of several newly developed methods for determining trace constituents in nickel baths.

In the determination of silica, a solution of ammonium molybdate acidified with sulfuric acid is added to 5 ml of the bath, diluted to 100 ml and allowed to stand for 15 minutes before measuring its transmittancy.

In the determination of chromium (hexavalent), a 0.5 ml sample is adjusted to an acidity of 0.2 N with nitric and sulfuric acid, diphenylcarbazide reagent is added and forms a red-violet complex. After dilution to 25 ml, the solution is measured for transmittancy with a colorimeter. For total chromium content a 0.5 ml sample is evaporated to fumes with sulfuric, nitric and perchloric acids, the trivalent chromium oxidized in acid solution by means of ammonium persulfate with silver as a catalyst, any manganese which is also oxidized reduced with a little hydrochloric acid, and diphenylcarbazide added to form the red-violet complex. The intensity of the color is determined after centrifuging a portion of the solution.

In the determination of zinc, copper and iron are removed by precipitation with cupferron and extraction of the cupferrides with n-amyl acetate. The solution is buffered with ammonium tartrate to a *p*H of 8.8 and sodium diethanoldithiocarbamate added to form a complex ion. This is then converted to zinc dithizonate and extracted from the mixture with a solution of dithizone in carbon tetrachloride. After washing with a sodium diethanoldithiocarbamate solution of *p*H 8.8, the extract is diluted to volume with solvent, and the transmittancy of the red zinc dithizonate measured.

In calcium determinations, the calcium in a 5 ml sample is separated from the nickel and other heavy metals by precipitating the latter with sodium hydroxide at *p*H 10.5. After filtering off the precipitate, the calcium is precipitated as the oxalate at a *p*H of 3.7 in the presence of a formic acid buffer, digested, filtered, dissolved in dilute sulfuric acid, and added to 2 ml of a 0.9 N solution of potassium permanganate. After dilution to 100 ml and standing a short time, the transmittancy of the remaining permanganate is measured.

For determining aluminum, the nickel is removed along with some of the other heavy metals by the addition of sodium diethyldithiocarbamate to an acidified 1-ml sample and extracting the precipitate with chloroform. The aqueous layer is buffered to a *p*H of 5.5 with ammonium acetate, and a red lake developed by the addition of aluminon. The transmittancy is measured a half hour after the aluminon addition.

Sodium determinations are carried out by means of adding a solution of magnesium uranyl acetate to a 2 ml aliquot of the bath in a test tube. After suitable shaking, a suspension of sodium magnesium uranyl acetate is formed, the transmittancy of which is measured after five minutes.

For determining ammonia, an aliquot of the bath is placed in a micro Kjeldahl flask through which a current of steam flows. Sodium hydroxide is added and the mixture boiled. The liberated ammonia is collected in a Nessler tube. The colored system is developed by adding Nessler's reagent and diluting to 50 ml. The transmittancy is measured.

The comparatively new method for determining sodium and other alkali metals using a Flame Photometer was tested by the authors and found to have much promise for determining sodium in nickel plating baths. In this instrument, a sample of the bath is atomized and the fine spray made to enter the base of a burner, imparting a yellow color to the flame. The intensity of the color is proportional to the amount of sodium in the sample.

Effect of Surface Finishing of Non-Ferrous Base Metals on the Protective Value of Plated Coatings (A.E.S. Research Project No. 4), by George J. Kahan, U. S. Time Corporation, Waterbury, Conn.

Project No. 4 undertakes to study the effects of surface finishing of alpha brass, cast brass and zinc base die castings on the

protective value of plated coatings.

Surface preparation of the alpha brass will include polishing and buffing, buffing only, electropolishing, bright dipping, and polishing with greaseless satin finish compound. The cast brass will be treated by polishing with coarse abrasive grain, buffing and coloring and by polishing with fine abrasive grain, buffing and coloring. The zinc base die castings will be buffed and colored, polished to remove skin, buffed and colored.

The electrodeposited coatings on the panels are to conform to the heaviest coatings required by A.S.T.M. specifications.

Three exposure sites for the plated specimens are planned to represent typical rural, industrial and marine conditions.

Some Effects of Copper in Nickel Plating Solutions (A.E.S. Research Project No. 5), by D. T. Ewing and William D. Gordon.

This project is directed primarily to the determination of the effects of small amounts of metallic and organic substances in electroplating solutions and to their removal. At present, investigations are going forward on the effects of various amounts of copper in four nickel plating baths: a high and a low *p*H Watts type solution, an alloy type bath, and a bath containing organic brighteners. The properties to be investigated are ductility, appearance, adhesion, hardness, corrosion resistance, throwing power, coverage, and distribution of deposit.

Some findings were reported. In the low *p*H Watts bath, copper caused a decrease in salt spray resistance by as much as 50 per cent and 50 mg/l copper resulted in roughness and pitting on edges. In the high *p*H Watts bath, the effects were less pronounced.

Protective Power and Porosity of Electrodeposits (A.E.S. Research Project No. 6), by N. Thon, Princeton University, Princeton, N. J.

This paper reviews the work reported in recent issues of THE MONTHLY REVIEW. Particular attention is paid to the significance of the ferroxyl test which in its original form is highly corrosive to nickel and hence meaningless as a porosity test. High ferricyanide with very low sodium chloride or, still better, high ferricyanide with sodium sulfate reagents are safe to all practical purposes. However, they reveal gross straight-channel pores only and not the fine winding pores which may well determine corrosion on long exposure.

Evaluation of Methods for Determining the Thickness of Electrodeposited Coatings (A.E.S. Research Project No. 7), by Harold J. Read, Pennsylvania State College, State College, Pa.

In this study, methods of proven unreliability, applicability only to very limited or unusual range of thickness, or requiring expensive, cumbersome or very special equipment or highly trained personnel have been eliminated.

The early work on the microscopic method showed that even qualified individuals obtained surprisingly diverse results especially on thin coatings, indicating need for much further study.

Chemical methods include weight loss tests and rate-of-chemical-reaction tests. The former require thorough knowledge of the density of the deposit which will be furnished by A.E.S. Research Project No. 9. The latter may be affected by internal stress which is now being studied.

Three different instruments for measuring thickness by magnetic means are being studied, the Magne-Gage, The General Electric Thickness Gage, and Lipson's Gage.

General Consideration of Experimental Methods for Determining Polarization (A.E.S. Research Project No. 8), by A. L. Ferguson, University of Michigan, Ann Arbor, Michigan.

Polarization is defined as the departure of the potential of any electrode in any solution from its equilibrium value in that solution as a result of the passage of current through the electrode. Overvoltage is then positive polarization and the two words, overvoltage and polarization, are frequently used interchangeably. It was emphasized that overvoltage is an active potential and is in no way related to an IR drop through the solution or any kind of film on the electrode.

While polarization is related to many phenomena such as grain size of deposit, throwing power of plating and electro-

polishing baths, composition of alloy coatings, etc., its actual function is one of the unsolved problems in electrochemistry. One reason for this is in the difficulty of measurement which is discussed in detail.

Probably the most suitable cell for every day industrial purposes is the well known Haring cell. Variations of this cell and other cells for determining polarization and overvoltage were described.

Early experimental work will concern itself with the high overvoltage metals: nickel, cobalt, and iron.

Physical Properties of Electrodeposits (A.E.S. Research Project No. 9), by Abner Brenner and C. W. Jennings, National Bureau of Standards, Washington, D. C.

Electrodeposits can be obtained with a greater range of properties than the metallurgical products, depending on conditions of electrodeposition. The properties to be studied are those of direct importance to engineering applications: hardness, tensile strength, ductility, fatigue resistance, and stress. These are to be correlated with such properties as structure, hydrogen and oxygen contents, density, and electrical resistivity, all of which give sensitive indications of the nature of the deposits.

Nickel deposits from various baths will be studied first. Some data from the literature are presented.

Disposal of Plating Room Wastes (A.E.S. Research Project No. 10), by Barnett F. Dodge and Dinwiddie C. Reams, Yale University, New Haven, Conn.

Inasmuch as the necessary treatments to produce a harmless effluent are quite different, the various types of wastes were classified as follows: 1. acid wastes without chromates or cyanides, 2. chromate wastes, and 3. cyanide wastes. The volume and composition of the wastes must first be determined, as they govern the design of any treatment process.

With the exception of silver and gold, disposal systems for wastes in the plating plant are more economical than product recovery. Data are very incomplete on plating room wastes, although considerable work has been done on the effect of various impurities on aquatic life and on the bacteria active in sewage disposal systems. There seems to be no general agreement on the amount of impurities, particularly copper and chromate, which can be tolerated by the biological action in sewage treatment plants; probably 1/10 ppm of copper or chromate are likely to cause trouble.

Available methods need further development to adapt them to the needs of each plant; hence, one of the main objectives of research in the field is to develop simpler, cheaper, and more flexible processes than are now available.

One good method of approach to the problem is to use one waste to neutralize another; another is to treat wastes for re-use; still another is a combination of the first two.

In acid wastes containing metal cations, additions of a waste alkali or lime (not limestone) will neutralize the acid and precipitate all heavy metals.

In acid wastes containing chromate, the usual method is to reduce the hexavalent chromium to its trivalent state by means of a reducing agent whereupon the chromium can precipitate by lime just as other metal cations. Common reducing agents used for this purpose are metallic iron or zinc, sulfur dioxide, sodium sulfite or bisulfite, sulfides, and ferrous sulfate.

One of the oldest methods of treating cyanide wastes involves acidification with sulfuric acid or acid wastes to a *p*H of about 4 followed by boiling or blowing with air to liberate hydrocyanic acid gas. A fairly recent method makes use of chlorine to oxidize the cyanide radical to cyanate which is much less toxic. Further addition of chlorine will oxidize the cyanates to carbonates.

Ion exchange equipment, in which synthetic resinous materials have the power of exchanging one cation for another, have been developed. This type of equipment has many advantages: it may be adapted to continuous treatment, and there is the possibility of being able to affect a separation of metals from their salts if recovery is desired.

The authors reviewed tested methods for treatment of copper, nickel, chromium and acid wastes, including a separate installation for copper cyanide waste; rinse waters from silver plating operations; brass pickling wastes; and methods for disposal of cyanide and chromate wastes.

Health Hazards in the Electroplating Industry, by Jerome E. Molos, Industrial Hygiene Engineer, Industrial Hygiene Section, Health Division, City of St. Louis, Mo.

With proper control and reasonable vigilance, health hazards can be controlled to the extent of preventing injury to workers. That such control has been successful in most cases has been shown in a recent extensive survey in St. Louis.

Ingestion of chemicals should be anticipated by storage in out-of-the-way areas, preferably under lock and key and by permitting handling only by competent individuals.

Skin contact with solutions causes irritations or ulcerations. Protective clothing and even goggles or face shields in some operations as well as adequate and properly maintained lavatories are required. The use of a mechanical hoist for handling work in open vapor degreasers is another must.

Inhalation of vapors, gases, mists and dust is best prevented by local exhaust ventilation. Polystyrene chips, etc., are effective as a supplemental control means for chromium plating but are not sufficient by themselves, the concentration in the workers' breathing zone being found to be from 10 to 20 times maximum allowable concentration. Acid tanks should be separated from tanks containing cyanide to prevent cyanide poisoning. Other hazards touched upon include fumes from hot acids and nitrous fumes from bright dips, degreaser fumes, and sandblasting, grinding, polishing and buffing dusts.

—K. G. SODERBERG

Constitution Revision Committee

The Constitution Revision Committee consisting of A. W. Logozzo (Hartford Branch), Chairman, and Frank J. MacStoker (New York Branch), Frank R. Keller (Pittsburgh Branch), Cleve F. Nixon (Detroit Branch) and Clyde Kelly (Chicago Branch) has now been appointed. Each of these men is known for his interest in the Society, work in his own Branch, and ability diligently to pursue and complete assignments of this nature.

In order to conform to the instructions of the Delegates at the Convention, members of the Committee are responsible for correlating the ideas of all the Branches. Therefore, each member has been assigned Branches as follows:

A. W. Logozzo: Boston, Bridgeport, Hartford, New Haven, Providence-Attleboro, Springfield, Waterbury and the Australian Branches in Adelaide, Melbourne and Sydney.

F. J. MacStoker: Buffalo, Montreal, Newark, New York, Rochester, Syracuse and Toronto.

F. R. Keller: Baltimore-Washington, Cincinnati, Columbus, Dayton, Lancaster, Philadelphia, Pittsburgh and Southeastern.

C. F. Nixon: Cleveland, Detroit, Grand Rapids, Indianapolis, Jackson-Lansing and Toledo.

C. Kelly: Chicago, Los Angeles, Milwaukee, Rockford, San Francisco, St. Joseph Valley, St. Louis and Twin City.

A plan for the procedure to be followed in presenting the proposed revision is being prepared by the Executive Board. It is expected that these details will be completed and submitted to the Committee during September.

The last revision prepared by the former committee will be used as a basis for the revision to be presented at the next Convention.

However, the Executive Board feels that this should be revised prior to submitting it to the Branches in order to embody features which it feels should be included. Each of these changes will be accompanied by a reason for the change.

In order to accomplish this huge task in time to have the Branch ideas correlated and meet a January publishing date, it will be necessary for the Committee to have all the Branch comments prior to November 1st. It is, therefore, urgently requested that each Branch appoint a committee to study the last revision and be prepared to offer comments as soon as called for by the Committee.

KENNETH M. HUSTON,
President.

1948 Convention and Exposition

The 35th Annual Convention of the American Electroplaters' Society will be convened on June 28 to July 1, 1948, in the Ambassador Hotel, Atlantic City, N. J.

The Industrial Finishing Exposition will be held during the same week in Atlantic City Convention Hall.

Mr. Horace Smith, Past President and Honorary Member of the Society, is the General Chairman of the Newark Branch Convention Committee.

Detailed plans will be published as they are received.

New Branch Library

Through the courtesy of MESSRS. H. BENNER, C. O. DURKIN, R. C. FANCHER, C. M. KNIGHT, B. F. LEWIS, A. ROBINSON, R. B. SALTONSTALL, and W. W. WILSON, and with the assistance of the Executive Secretary's Office, the Detroit Branch has now succeeded in establishing files of THE MONTHLY REVIEW and the *Proceedings* as follows in *Hooker-Kresge Library, Detroit, Mich.:

THE MONTHLY REVIEW, 1923—complete
Proceedings, 1934–1937, 1942—complete.

Excess copies collected from members are being donated to the Executive Secretary's Office for distribution to other Branch libraries.

Future A.S.T.M. Meetings

Members of A.S.T.M. will be interested in knowing that the next Committee Week and Spring Meeting will be held in Washington, D. C., during the week beginning March 1, 1948.

The 51st Annual Meeting and 8th Exhibit of Testing Apparatus and Related Equipment will be held in Detroit, Mich., June 21 to 25, 1948. The Book-Cadillac Hotel will be the headquarters.

Apology

The following letter has been received from Mr. M. H. Orbaugh: "I must apologize for a serious oversight on my part in submitting data to you for my article on "Engineering Electroforming", published in the July issue of THE MONTHLY REVIEW.

"The graph in Fig. 4, page 812, was submitted to you in error. Since it already has been published, I can only ask that you give the proper credit for this data to Mr. E. J. Roehl of International Nickel Company Research Laboratories, Bayonne, N. J."

Corrections

Robert W. Renton of Euclid, Ohio, has been elected Chairman of the International Fellowship Club for 1947–1948, and not Robert L. Redmond of Automotive Rubber Company, as stated in the August issue of THE MONTHLY REVIEW.

MR. ALBERT HIRSCH, the newly elected Honorary Member of the A. E. S., advises that while he completed the courses at Temple University he did not receive a B.S. degree as stated in the August issue. This degree was not awarded to afternoon and evening students until a year or two later.

The name of one of the companies given in the Speakers List sent to Branch Secretaries was misspelled. The complete item should read:

DIVINE BROTHERS (c)
200 Seward Avenue, Utica 1, N. Y.
Contact WILLIAM C. BEDDOE, Advertising Manager
Subject: *Polishing and Buffing Wheels*

Correction is also due in another Speakers List item. Under WESTERN ELECTRIC COMPANY, MR. C. R. FISCHRUPP's name was misspelled and his subject should be: 2. *Current Industrial Plating Methods of Zinc, Nickel and Chromium in Semi-Automatic Equipment.*

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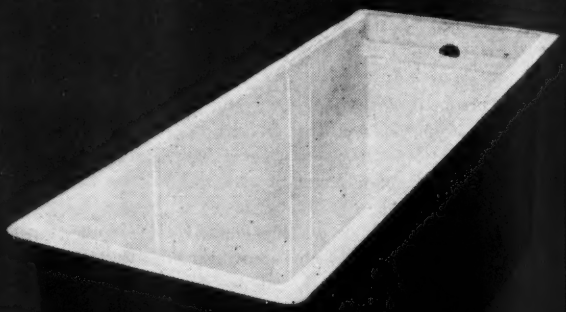

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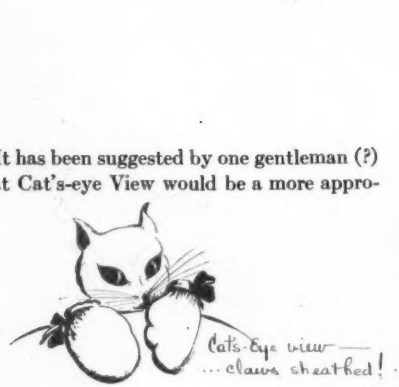
Wives-Eye View

OF THE CONVENTION

by Frances Weisner and Collaborators

It has been suggested by one gentleman (?) that Cat's-eye View would be a more appro-



priate title, but very few meows were heard and all claws were sheathed for the duration. If anyone failed to have a good time it was her own fault, for everything possible was done to insure our enjoyment of the occasion. The vast volume of purrs ascending from each gathering of the feminine contingent was the only indication of our feline natures.

Thanks to the gentlemen and orchids to the ladies of the Committee for a very wonderful time. The weather was perfect for a change, registration painless, the entertainment superb with just enough room in between for rest and shopping. And the food—ah-h-h!! Everything moved with such dispatch and smoothness that one did not think of the months of careful thought and planning which had been expended.

After a trip through Edison Museum, which left us feeling quite young and modern, and through Greenfield Village, where we learned how to weave and tell the difference between winter and summer wheat, we were entertained beautifully at luncheon in the ballroom of Dearborn Inn. Music by the Ford String Ensemble was lovely and the hats, my dears, were simply out of this world. Small favors and an amusing toy kept us occupied between our arrival and that of the food, which was—mm-mm—good.

Wasn't that an excellent dance orchestra at the Open House Monday eve? We had a wonderful time even though we didn't win

one of those numerous door prizes. I wonder what happened to all the sandwiches that were left over, or were they?

Those lucky enough to get tickets said the Broadcast was very entertaining, and if you sat on the aisle and were a bit boisterous you were likely to get on the air and, incidentally, carry home one of several nice gifts. Not being lucky, I spent a leisurely morning shopping and happened on the lovely table arrangements which took top honors in Crowley-Milner's contest. I didn't know the names of most of the flowers, but no one else around there did either, so I was right in the swim.

Tuesday afternoon was occupied with calls on relatives, and in the evening we spent a while calling on Messrs. Udylite, Harshaw, Diversey, etc. Did anyone else happen to see the sunset from the fourteenth floor of the Statler? That picture of the Detroit skyline against the backdrop of a typical Lake Michigan sunset will shine among my most treasured memories.

Luncheon at the Yacht Club was another masterpiece of fine entertainment. How would you like to have 57 unexpected guests drop in for luncheon? That's what happened there and they were served with unruffled calm. Again many lovely gifts were distributed, and although none of them landed on our table, we certainly can't say we weren't lucky this time. We were fortunate to have the only male guest present at our table and a very fine gentleman he is. We enjoyed your company very much, Arthur Graham! As if that and the wonderful food and clever MC-ing of Fran Harris weren't enough, we had the honor and great pleasure of riding in the car that chauffeured Miss Harris back to the radio station. On the way in, the conversation was largely about her work in combating child delinquency, and very flatteringly she asked our advice about raising her own children.

Back to the Statler to kick off our shoes and recoup with a bit of refreshment and spirited chatter before dressing for dinner with friends. We intended to use those theater tickets but made the mistake of wandering out to the Exposition for a few minutes first. You know the rest.

Can you imagine breakfast being served to a group of 350 and the food arriving so hot you burn your tongue? So help me, I did. Hudsons should be encouraged to try their Breakfast Style Show again after such a successful initiation. They certainly picked the right occasion to try it out because a nicer group of well-mannered women could hardly be found—guess electroplaters know how to pick their ladies. Altogether, the breakfast was a red letter occasion what with red leather billfolds, red playing cards and red roses. And from the looks of those dresses in the style show, there may be some red letter entries in a few family ledgers.

Out to the Exposition again in the afternoon where I had the very special pleasure of meeting Mr. Rancoti, that charming gentleman from Italy. We had to converse

(*Continued on page 1066*)

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Colorimetric Determination of Molybdenum in Zinc Cyanide Plating Solutions

LOUIS SILVERMAN, VIRGINIA STEWART and JAMES DAVIES. *Metal Finishing* **44**, 426-428 (1946).

By method described, concentrations of molybdenum as high as three milligrams per hundred milliliters of aqueous solution can be determined. Gives details of procedure, experimental results and sample calculations.

Dip Finish for Light Metals

ANON. *Modern Metals* **2**, 37–38 (Nov. 1946).

Discusses briefly preparation of Tenite II gel lacquer and the dipping process. Cites its advantages and limitations.

Gel Lacquer Coatings

ANON. *Steel* **119**, 76–77, 98, 100, 105 (Oct. 28, 1946).

New way to apply a durable "plastic veneer" finish by dipping articles in a gel-forming cellulose-ester lacquer. Gives brief account of preparation of gel, equipment required, application, maintenance of compositions.

Porcelain Enameling Characteristics of Some Common Ferrous Metals

W. A. DERINGER. *J. Am. Ceramic Soc.* **29**, 332–340 (1946).

Five common commercial ferrous metals, hydrogen annealed SAE 1010 steel, and carburized titanium-bearing enameling iron were coated with porcelain enamel and subjected to various tests, which are described in detail with photographs of some of the results. Results indicate a relationship between the hydrogen behavior and enameling characteristics which can best be explained on the basis of diffusibility of atomic hydrogen through the metal and which is in no way affected by the total carbon content or by the stabilization of the carbon through the formation of carbides other than iron carbide.

Equipment Considerations for Automatic Cleaning and Pickling

NATHAN RANSOHOFF. *Finish* **3**, 20–22 (Nov. 1946).

Describes the "grasshopper" type machine for continuous pickling in which work is loaded into crates or hung from fixtures. Crate or fixture, after loading, is hung onto the conveyor chains of the machine at the charging end and advances automatically through the various processes. Refers specifically to its use for pickling shell cases and the problem of trapping air and drainage of shells.

Chevrolet's New Setup for Plating Bumpers

ANON. *Automotive and Aviation Industries* **95**, 18–21 (Nov. 1, 1946).

New electroplating department which was recently placed in operation produces a nickel coating of 0.0015 inch, resulting from a cycle of 1½-hour duration in the nickel plating unit. Describes and illustrates complete sequence of operation.

Electroplating, Polishing and Buffing at the U. S. Naval Gun Factory, Washington, D. C.

ALBERT L. FRY. *Metal Finishing* **44**, 467–471, 478 (1946).

Plating gun barrels; finishing equipment; finishing work; plating preparation; plating solutions; and cadmium strip.

Cadmium Plate and Passivated Cadmium-Plate Coatings

E. E. HALLS. *Metallurgia* **34**, 295–297 (1946).

Results of tests, which are described, indicate a method of processing which will give satisfactory performance. Test pieces of mild steel and of brass and copper were used.

Polishing and Plating Oldsmobile Three-Piece Bumpers

CHARLES O. HERB. *Machinery* (American) **53**, 158–165 (Nov. 1946).

Outlines procedures followed in most modern electroplating departments.

Hard Chromium Plate and Its Uses

J. M. HOSDOWICH. *Materials & Methods* **24**, 896–900 (1946).

Magnified cross sections show the difference between decorative chromium plate and hard chromium plate; comparative hardness of metals; and comparative static friction of various metal surfaces given in scales. Discusses characteristics and many uses.

Deposition of Metal on Plastics

E. A. OLLARD and E. B. SMITH. *Plastics* **10**, 527–530, 551, 604–608 (1946).

Discusses preliminary treatment and sensitizing; silver by reduction; reducing solutions; techniques of silvering; temperature considerations; spraying method; method of suspension in the plating solution; plating, polishing and finishing; plating of designs; plating for non-decorative purposes.

Electrolytic Cutting of Metal

K. Y. SKORNIAKOV. *Promishlennaya Energetika* 11 (Jan. 1946); *Engr's Digest* (Am. Ed.) **3**, 498 (1946).

Describes a new way of cutting metal by a combination of electrical and mechanical action which has been introduced in Russia. It takes the place of circular saw work and is particularly suitable for heat-treated steels, hard alloys and thin tubes, but is also useful for ordinary sections. A rotating disc is pressed against the work and electric current passes from the work through an electrolyte to the disc, rapidly removing the metal by electrodynamic and electrochemical action.

Effect of Impurities on the Electrodeposition of Manganese

DAVID SCHLAIN, JOHN D. PRATER, and BEATRICE L. LUKENS. *Mines Magazine* **36**, 401–404, 420 (1946).

Effects of zinc, iron, arsenic, lead, vanadium, and dithionate ion were investigated. Results are tabulated and summarized.

A New Addition Agent for the Electrolytic Refining of Tin and Lead

FRANK C. MATHERS and MAURICE M. FELGER. *Electrochem. Soc.* Preprint **90**–28, 1946, 4 pp.

"Hexanol-3 tails," phenol coefficient 16, was found to be an excellent addition agent for the electrolytic refining of tin from a stannous sulfate-sulfuric acid electrolyte, 1.93 lb being required per ton of tin refined. In the electrolytic refining of lead from the fluosilicate bath, 0.8 lb is required per ton of metal refined. Hexanol-3 tails is a complex mixture containing phenolic compounds that remain after the higher tar acids have been removed from certain coal tar distillation fractions. These impure mixtures of aromatic hydroxy compounds of the higher homologs of phenol are better addition agents than the corresponding pure compounds or mixtures of pure compounds.

Metal Coatings and the Surface Protection of Molds

MARCEL BALLAY. *Fonderie* **1946**, no. 8, 285–300.

The author analyzes methods of surface treatment of castings such as metallic and non-metallic coating, physico-chemical treatment (through absorption or diffusion), chemical (oxidation, phosphating, bonderizing, etc.), and electrochemical (anodic oxidation). Descriptions of the methods and their application under different conditions are given.

Investigation of Aqueous Acrysol, Geon and Saran Dispersions

ANON. *Paint J.* **31**, 17–23 (Nov. 5, 1946).

These polymers are evaluated in the light of possible application by the paint industry as basic new raw materials. Investigation was confined to those materials which a preliminary survey indicated might be most generally useful as surface coatings and the processing and application of which would not represent too wide a departure from standard painting practice. On this basis, Geon, the Acrysols, and Saran were chosen for consideration. Principles of formulation and a suitable processing technique are outlined and certain precautions suggested.

Electrodeposition and Refining of Bismuth

ROBERTO PIONTELLI. *Chimica e L'Industria* **20** (Aug. 1938).

After a short bibliographical review, different methods of electrolytic bismuth deposition and refining are discussed. The most appropriate methods for specific uses—preparation of metal, industrial and pharmaceutical uses, etc.—are indicated.

Wheels and Compounds for Buffing and Polishing

JOHN HYLER. *Steel* **119**, 92–93, 117 (Dec. 10, 1946); **120**, 84, 87–88 (Jan. 20, 1947).

Discusses buffing wheels made of fabrics, felts, and leathers and purposes for which they are best suited, also some of the more dependable techniques employed in high speed production.

Reducing Embrittlement in Electroplating

C. T. ESKIN and H. W. LOWNIE, JR. *Iron Age* **158**, 69–72 (Nov. 21, 1946).

Outlines procedures, substantiated by several years of production application, whereby embrittlement can be minimized during the plating operation and removed by heat treatment following plating. A non-acid method for deplating is also presented.

The Significance of Polarization in Electroplating

H. BANDES. *Metal Finishing* **44**, 516–521 (1946).

Factors such as current efficiency, alloy deposition, structure of deposits and throwing power are discussed and the significance of polarization is emphasized. In author's opinion, precise polarization data will be required if many of the unknowns of the art of electroplating are to be understood.

The Accurate Volumetric Determination of Zinc and Nickel Using Diphenylcarbazone as Indicator

B. S. EVANS. *Analyst* **71**, 455–459 (1946).

Methods are described for volumetric determination of zinc and of nickel by a new process, each method being available for very low quantities and for a wide range of sample weights; volumetric determination, without separation, of zinc in nickel plating baths, and detection of an excess of zinc over a given amount in nickel plating baths.

Plating with Gold

H. M. HABERMAN. *Metal Finishing* **44**, 525–528 (Dec. 1946).

Four methods of plating with gold are described in detail, including the common processes for obtaining the various hues, such as red, green and white.

Electrophoresis of Rubber Latex

GEORGES GENIN. *Rev. Gen. Caout.* **21**, no. 11 (1944).

Reviews history and various theories of the mechanism of electrophoresis. Discusses electrophoresis of rubber latex with reference to factors affecting rate of deposition and nature of deposit, deposition on zinc electrodes and on a porous diaphragm, techniques of deposition, and industrial applications, also briefly the electrophoretic deposition of synthetic resins.

Anodic Treatment of Aluminium

ANON. *Aluminium and Non-Ferrous Rev.* **2**, 58, 60–62 (July-Sept. 1946).

Reviews German and Japanese processes for anodic oxidation of aluminum, then describes briefly English development work including superposition of AC on DC for better quality films, production of waterproof films, and utilization of the film porosity for certain applications. Then takes up commercial practice, covering pretreatment and electrical equipment in this installment (To be continued).

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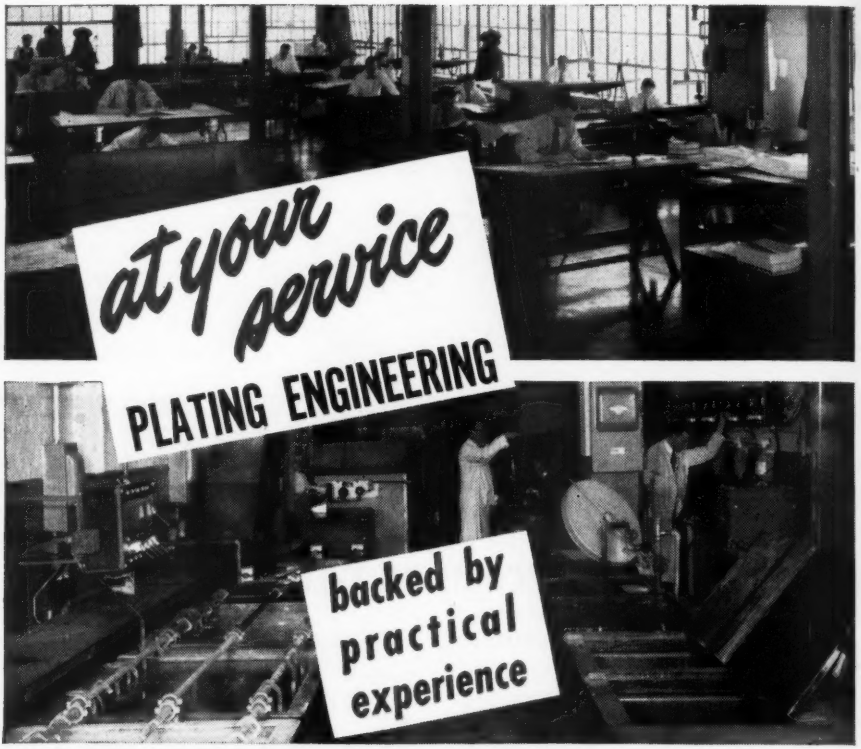

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By GEORGE B. HOGABOOM
Consultant, New Britain, Conn.

No. 2,421,316, May 27, 1947—Electrolytic Etching Bath—K. J. Carson and J. M. Kelly, assignors to Western Electric Company.

CLAIM. As a bath for the electrolytic etching of samples of nickel base alloys in preparation for metallographic examination, a water solution consisting of about 62 parts by volume of 38 per cent hydrochloric acid, about 35 parts by volume of 10 per cent solution of ferric chloride in water, about two parts by volume of glacial acetic acid, combined with about one part by volume of a water solution proportioned to contain about three grams of an alkali (preferably potassium) dichromate, about three cubic centimeters of oil of vitriol (conc. sulfuric acid) and about 0.10 gram sodium chloride in each 100 cc of water.

No. 2,421,079, May 27, 1947—Method for Silvering Non-Conductive Materials—Harold J. Narcus.

CLAIM. A method of metal coating the surface of a non-conductive material which comprises roughening said surface, cleaning the surface to remove foreign substances, immersing same in the following solution for a period of ½ to 1 minute

Stannous fluoborate, grams	15–20
Fluoboric acid (42%), cc	250
Sodium chloride, grams	75–100
Water, cc	1000

to cause the surface to be receptive to the formation of a subsequent conductive layer, thoroughly washing the same to remove excess of the solution and then treating the properly washed material in any of the usually employed silvering solutions.

No. 2,423,624, July 8, 1947—Indium Plating—Clarence F. Smart, assignor to General Motors Corporation.

The indium plating bath or electrolyte in accordance with the invention may be made by dissolving tartaric acid in water to make a concentrated solution, and adding thereto a compound of indium that is soluble in tartaric acid solution and allowing it to dissolve therein. The composite solution is then diluted with water and made slightly ammoniacal with ammonium hydroxide. If desired, a material such as ammonium chloride may be added to improve the conductivity of the bath, although such constituent is not essential. I have found that indium which is not normally soluble in a solution which is alkaline with ammonium hydroxide is, however, permanently soluble in such alkaline solution when tartrate radical is present; also that such ammoniacal tartrate solution of indium comprises an excellent plating solution.

CLAIM 5. A process for the electrodeposition of indium, which comprises dissolving tartaric acid in water to make a concentrated solution, dissolving indium hydroxide in said concentrated solution, diluting the resulting solution with water, adding ammonium hydroxide to said dilute solution until the same is ammoniacal, and passing electric current through the ammoniacal solution from an anode to a cathode at a

voltage of about four and a current density of about thirty amperes per square foot of cathode area while said ammoniacal solution is maintained at a temperature of about 70 to 75° F.

5 Claims.

No. 2,421,863, June 10, 1947—Process for Driving Out Occlusions of Gases Like Hydrogen from Surface Layers of Workpieces—Richard Beck, vested in the Attorney-General of the United States.

CLAIM 1. A process for cleaning, comprising driving out of occluded gases and removal of oxide films and surface embedded impurities including carbides from the exterior layers of metals consisting in using the metal to be cleaned as an anode in an aqueous bath where the *p*H is at least 7, operating this bath with current impulses whose duration varies from one second to sixty seconds according to the metal to be cleaned and is sufficiently long to oxidize impurities in and on the metal surface and to remove occluded gases but is stopped before oxidation and solution of any metal of the surface takes place, repeating these anodic impulses a sufficient number of times to bring about a gas development which is uniform over the entire surface area and depositing an additional metal layer by electroplating.

3 Claims.

No. 2,422,242, June 17, 1947—Electroplating Fixture—M. Kaufman.

CLAIM 7. Apparatus for electroplating a circumscribed band-like area about an object disposed in a suitable electrolyte, said apparatus comprising a tubular anode member to be disposed in said electrolyte about said band-like area in spaced relation thereto, tubular shield means embracing said object above said band-like area as said object is positioned in said electrolyte, said shield means terminating adjacent the upper edge of said band-like area, and second shield means embracing the surface of said anode member remote from said band-like area, said second shield means having a portion extending inwardly from the lower edge of said anode member and terminating adjacent to the lower edge of said band-like area.

8 Claims.

No. 2,422,902, June 24, 1947—Method of Electrolytically Cleaning and Plating Conductors Consisting Principally of Copper—K. M. Huston, assignor to Western Electric Company.

CLAIM 3. The process for continuously cleaning and plating bronze conductors partially coated with tin, which comprises continuously and simultaneously advancing such a conductor as a cathode through an electrolytic cleaning cell in which the electrolyte consists solely of a fluosilicic acid solution of from 10 to about 60 per cent concentration, advancing the conductor directly from the electrolytic cleaning cell through a lead electroplating cell including an electrolyte consisting essentially of a solution of lead fluosilicate and free fluosilicic acid, and making the moving conductor a cathode in the lead electroplating cell to cause lead to be deposited thereon.

3 Claims.

No. 2,424,173, July 15, 1927—Electrolytic Production of Alloy Coatings—K. M. Huston, and Vincent A. Rayburn, assignors to Western Electric Company.

CLAIM 3. The method of continuously electroplating a uniform brass coating upon a metallic strand, which comprises advancing such a strand as a cathode through an electrolytic cell employing an aqueous electrolyte having the composition of approximately 9.8 ounces of copper cyanide per gallon of electrolyte, 1.8 ounces of zinc cyanide per gallon of electrolyte, and 4 ounces of free sodium cyanide per gallon of electrolyte; making a mass of divided bodies of scrap material composed of brass and metal of the group consisting of copper and zinc the anode in the cell, the initial composite composition of the anode being approximately 80 per cent copper and 20 per cent zinc; passing an electric current through the cell to continuously plate a brass coating having a composition of approximately 78 per cent copper and 22 per cent zinc upon successive increments of the moving strand; maintaining the composition of the brass coating plated upon the strand substantially constant by adding divided bodies of scrap

material composed of brass and metal of the group consisting of copper and zinc to the divided anode bodies as the plating progresses in such quantities and proportions as to maintain the concentrations of copper and zinc ions in the electrolyte substantially constant and at substantially their initial values; and continuously washing the divided anode bodies with the electrolyte to remove the sludge therefrom by causing a plurality of small rapidly moving jets of the electrolyte to impinge directly upon the divided anode bodies, said jets being directed in one general direction, but alternately upwardly and downwardly whereby a turbulent stream of the electrolyte is produced.

NOTE FROM LEGEND: "It is preferable to provide means for washing the sludge from the divided anode material, because the sludge deposited upon the anode material tends to suppress the anodic corrosion thereof. By using the electrolyte to wash the sludge from the anode material, no dilution of the electrolyte occurs and consequently, no loss in the plating efficiency of the bath results".

9 Claims.

No. 2,424,472, July 22, 1947—Tin Plating from Potassium Stannate Baths—F. A. Lowenheim and M. M. Sternfels, assignors to Metal and Thermit Corporation.

One of the important discoveries as to the potassium stannate baths is that the concentration of stannate in the bath can be relatively high. Not only is potassium stannate more soluble than sodium stannate at all temperatures both in water and in solutions of the corresponding hydroxide, but the temperature coefficient of solubility of potassium stannate is positive rather than negative. The temperature of operation and/or the concentration can, therefore, be increased substantially above values commercially usuable in the operation of sodium stannate baths. Thus, while the maximum concentration of sodium stannate which has been recommended for practical use, is about 0.75 mol per liter (27 oz/gal), we have found that our potassium stannate baths can be employed at stannate concentrations substantially above this value, that is, up to at least 3.5 mols per liter (140 oz/gal) with advantages which increase as the concentration is increased.

An even more surprising fact which we have discovered is that, when potassium stannate bath is operated at these higher concentrations and temperatures, high cathode current efficiencies are obtained over substantially any desired range of cathode current densities. The curves of cathode efficiency plotted against cathode current density in the potassium stannate bath are quite flat and their maxima occur at current densities which are far above those of the sodium stannate baths. The plating speed in the potassium baths, for a given cathode efficiency can actually be increased more than five times that of any value obtainable with the sodium stannate bath. The potassium stannate bath has the additional advantage of providing a saving in power because of its greater conductivity. It also has a slightly higher throwing power than the sodium stannate bath.

	Plating Bath No.			
	1	2	3	4
Potassium stannate				
mols/liter	2.44	1.60	1.21	0.35
(approx. oz/gal.)	96	64	48	16)
Free KOH				
mols/liter	0.53	2.14	0.29	0.20
(approx. oz/gal.)	4	16	2	1.5)
Temperature, ° C				90
° F				194

CLAIM 1. A process for the electrolytic deposition of metallic tin, which comprises immersing an article to be plated in an aqueous plating bath of potassium stannate and free potassium hydroxide, and connecting said article as a cathode in an electric circuit, supplying plating current to said bath, said bath having a composition comprising essentially from 0.75 to 3.0 mols per liter (30 to 120 oz/gal) of potassium stannate, from about 0.15 to 3.5 mols per liter (1.1 to 26 oz/gal) of potassium hydroxide, and water, while maintaining the temperature of said bath within the range of about 70° C (158° F) to substantially the boiling point of said bath and while using a cathode current density ranging from about 100 to 1000 amperes per square foot.

9 Claims.

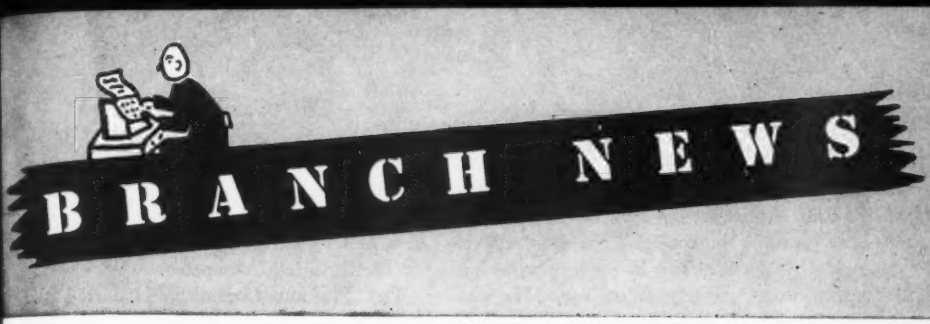
CHROMIUM CHEMICALS

FOR THE ELECTROPLATER

- BICHROMATE OF POTASH
- BICHROMATE OF SODA
- CHROMIC ACID

MUTUAL CHEMICAL COMPANY OF AMERICA

270 MADISON AVENUE NEW YORK 16, N.Y.



GRAND RAPIDS BRANCH

A *Symposium on Filtration* will be presented at the September 12 meeting with Messrs. HELBIG of Darco Corporation, AMBERG of Johns-Manville, and FAINT and LEONELLI of Industrial Filter and Pump Manufacturing Company as speakers.

PHILADELPHIA BRANCH

PRESIDENT ORLIK called the Branch Officers' meeting to order in the home of TREASURER GEORGE M. LONG, Willow Grove, Pa. on June 18.

Two applications for membership were referred to the Board of Managers, and two applicants were elected. There were also one reinstatement and one out-transfer to New York Branch.

The new "revised" Constitution was discussed and the Delegates were instructed to stand by the May meeting instructions to vote against it.

PAUL MENTZER, SR., *Secretary.*

SAN FRANCISCO BRANCH

Nineteen members attended the July 10 meeting in the El Jardin Restaurant, 22 California Street, San Francisco.

J. R. PATTENGER, our Branch Delegate to the Annual Convention in Detroit, presented his report in a very interesting manner. He chronicled the events at the business sessions and summarized the fourteen technical papers which were read. Mr. Pattenger also described a number of the exhibits among the approximately one hundred and twenty at the Industrial Finishing Exposition and depicted the conducted tour through the Pontiac Motor Company plant, stressing the extensive activities in automatic plating processes. His report ended on a social note as he told of the final banquet attended by about twelve hundred and fifty.

JACK HITE,
Secretary-Treasurer.

SOUTHEASTERN BRANCH

PRESIDENT R. E. NORMAN called the July 11 meeting to order following a very nice supper. There were fourteen members present including BILL BURTON from Chattanooga, Tenn., and E. J. SLEMONS from Spartanburg, S. C.

Most of the meeting was spent reviewing happenings at the Convention for the benefit of those less fortunate than ourselves, and all benefited very much by our "bull session".

H. R. STOGNER, B. DEUTSCHMAN, and GEORGE L. MCCABE are to assist LIBRARIAN CLEM HOHNER in preparing the programs and obtaining speakers of the most interest for the coming year.

The September meeting will be in the form of a party for our wives, time and place to be announced.

WILLIAM T. WEYMOUTH,
Secretary-Treasurer.

SYDNEY BRANCH

The July 8 meeting was attended by thirty-six members and visitors.

Four applications were dealt with and two new members were elected and welcomed by PRESIDENT E. J. WRIGHT.

The Educational Committee was asked to examine the possibilities of the Branch publishing a quarterly review or alternatively cooperating with other Australian Branches and try to issue a combined review.

LIBRARIAN MILLWARD introduced MR. A. L. PEACH, who gave one of the most interesting talks ever delivered before the Syd-

ney Branch. Mr. Peach formerly was connected with the Ministry of Munitions' Laboratories in England as an assistant to Dr. Gardam. He traced the developments of the electroplating industry during the war years in England and the great efforts made by the Industry to retrieve materials which were formerly of no use. He also mentioned the developments of peacetime production. Mr. Peach was warmly congratulated by the appreciative audience.

After the lecture, Mr. Peach with MR. P. EVANS was appointed to the Educational Committee; with their talent added to that already on the committee it augurs well for the future of the Branch as far as educational matters are concerned.

It was also decided that all lectures that are printed by the Branch would be forwarded to both the English and American Metal Industry publications.

J. R. GODFREY, *Secretary.*

SYRACUSE BRANCH

The last meeting for 1946–1947 held on June 20 in Leonard's Belvedere Restaurant was preceded by dinner. The new proposals for changes in the Constitution were discussed. CHAIRMAN M. BOLAND reported for the Research Committee.

The Election Committee reported the election of the following officers for 1947–1948:

President—NEIL C. MAFFEI
First Vice-President—LINDLEY S. WOOD
Second Vice-President—HERBERT N. GERHARDT
Secretary-Treasurer—M. P. BOLAND, JR.
Librarian—GEORGE SIMMONS
Board of Managers—A. G. MARTINEAU, W. A. PHILLIPS, and H. C. HOLBERT

The meeting concluded with a discussion of the program for the following year.

M. P. BOLAND, JR.,
Secretary-Treasurer.

WIVES-EYE VIEW

(*Continued from page 1053*)

through an interpreter since he speaks no English and I speak none of the five languages in which he is fluent. I did learn that he studied in Geneva, Switzerland, has traveled four continents and has the oldest and largest supply and equipment house (for electroplaters, that is) in Italy. In return for my rose from the Hudson breakfast he promised me the largest rose he could find in Italy when I come to visit. By all appearances Mr. Rancoti will still be around when I get there if it is within the next twenty years.

Stood in line for one of the little frying pans of which United Platers had given away 5,000 by Thursday afternoon. Tried the thimble thing-a-ma-gig—but no Savings Bond. Signed innumerable cards—but no prizes, as usual. It's odd that no matter how many coats they put on those little ladies at the MacDermid booth they were still nude.

The highlight of the Convention was the banquet Thursday, preceding which we spent a while greeting friends at the cocktail party given by Hanson-Van Winkle-Munning Co. in the English Room. We were half an hour early for the banquet and still sat in the second dining room. So many people! Again good food and good music were the order of the evening. It's a marvel how they can serve over 1,200 people in such close quarters and still have the hot food hot and the ice cream not melted a particle.

We had a long trip ahead of us so had to leave before the floor show was ended, but what we saw was excellent and we dragged ourselves away very reluctantly. Next year's committee will have to do some hustling to equal the performance of this one.

If I seem to have made too lavish use of superlatives I hope I may be forgiven, for nothing less could adequately convey a true picture of the Convention from the ladies' point of view.

P.S. We didn't win the convertible either. The old jalopy will just have to do till the next convention.

Start with a *Good Finish*

Cleaning Compounds formulated by The Puritan Manufacturing Company provide platers with the necessary requirements for satisfactory plating. PURICO Compounds eliminate superfluous operations . . . save time and labor . . . minimize rejections . . . speeds up production.

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ARTHUR W. LOGOZZO

Chairman, Membership Committee

ELECTIONS

CHICAGO BRANCH: Edward B. Anderson, Philip S. Anderson, Lawrence M. Darrow, Samuel M. Futval, Jr., Victor A. Holmes, Edward Wardzala

GRAND RAPIDS BRANCH: Earle Lee Blackeslee, Ward E. Burke, Claude D. Chrysler, Lawrence J. Cookingham, William Fowler, Warren B. Harnden, James Colby Hook, Jay O. Johnson, William L. Johnson, Jr., Harvey Kroeze, John Mulder, William F. Oberg, C. R. Peterson, James Phillips, Carrol B. Turner, Elmer R. Walek

PHILADELPHIA BRANCH: Jean Mermillod, Alfred R. Wanamaker

ROCHESTER BRANCH: Richard W. Nersinger, Sr.

ST. JOSEPH VALLEY BRANCH: William Frost, Robert Quinn, Eugene Roth

SAN FRANCISCO BRANCH: Henry A. Hales, Antone De Palma

SOUTHEASTERN BRANCH: John A. Hauser, D. H. Smith

SYDNEY BRANCH: A. L. Peach, A. I. Oakey

TOLEDO BRANCH: Joseph Lesko

TORONTO BRANCH: H. J. Butterill

TRANSFERS

E. W. Arnold from Detroit Branch to Los Angeles Branch, J. E. Fritts from Detroit Branch to Columbus Branch, Frederick C. Strong from Philadelphia Branch to New York Branch

REINSTATEMENTS

NEW YORK BRANCH: N. Fleet

PHILADELPHIA BRANCH: L. Sherman

SUSPENSIONS

GRAND RAPIDS BRANCH: J. Van Haver, L. P. Waite, John Manning

NEW YORK BRANCH: Peter D. Branton, Michael Parente, S. Louis Romeo, Ernest Turtell

SYDNEY BRANCH: C. C. Dunn, E. C. Hanbridge, R. Healy, R. Merriman, L. J. Phelan

WATERBURY BRANCH: Richard S. Burt

RESIGNATIONS

CHICAGO BRANCH: E. G. Walters

DETROIT BRANCH: W. G. Cowell, W. L. Grube

GRAND RAPIDS BRANCH: William Holwerda, L. Lyons, Jacob Markham, F. J. Upthegrove, M. B. Williams

NEWARK BRANCH: George F. Geiger, William J. Jancik

SOUTHEASTERN BRANCH: R. H. Heppel

DEATHS

TOLEDO BRANCH: Michael Spanolis

MEMBERSHIP CHART

BRANCH	Membership May 1, 1947	New Members	Net Change in Membership	Per Cent Net Change
FIRST GROUP				
GRAND RAPIDS	136	16	+ 8	+ 5.9
CHICAGO	410	20	+19	+ 4.6
BRIDGEPORT	147	10	+ 5	+ 3.4
CLEVELAND	192	9	+ 5	+ 2.6
LOS ANGELES	196	6	+ 5	+ 2.6
TORONTO	144	3	+ 1½	+ 1.0
WATERBURY	139	1	.....	.....
BOSTON	160	..	.....	.....
HARTFORD	141	1	− ½	− 0.4
PHILADELPHIA	218	7	− 2	− 0.9
NEW YORK	259	7	− 5	− 1.9
NEWARK	257	6	−15½	− 6.0
DETROIT	423	11	−36½	− 8.6
SECOND GROUP				
ST. JOSEPH VALLEY	88	6	+ 5	+ 5.7
PITTSBURGH	126	10	+ 6½	+ 5.1
SAN FRANCISCO	77	3	+ 3	+ 3.9
ROCHESTER	88	3	+ 3	+ 3.4
BUFFALO	98	3	+ 2½	+ 2.5
TWIN CITY	95	1	+ 1	+ 1.1
MILWAUKEE	124	3	+ ½	+ 0.4
ST. LOUIS	96	..	.....	.....
NEW HAVEN	114	..	.....	.....
PROV.-ATTLEBORO	126	..	− 1	− 0.8
DAYTON	90	1	− 2	− 2.2
BALTIMORE-WASH.	119	2	− 7	− 5.9
INDIANAPOLIS	103	16	−12½	−12.1
THIRD GROUP				
ADELAIDE	49	14	+13	+26.5
SYDNEY	59	8	+ 4	+ 6.8
TOLEDO	55	4	+ 3	+ 5.5
COLUMBUS	35	4	+ 2½	+ 4.2
SPRINGFIELD	73	4	+ 3	+ 4.1
LANCASTER	38	2	+ 1	+ 2.6
SOUTHEASTERN	43	2	+ 1	+ 2.3
SYRACUSE	73	..	+ ½	+ 0.7
MONTREAL	60	..	.....	.....
MELBOURNE	61	..	.....	.....
ROCKFORD	64	..	.....	.....
CINCINNATI	52	2	− 1	− 1.9
JACKSON-LANSING	49	..	− 1	− 2.0
TOTAL A. E. S.	4,877	185	+11	+ 0.4

Membership, August 10, 1947 4,888

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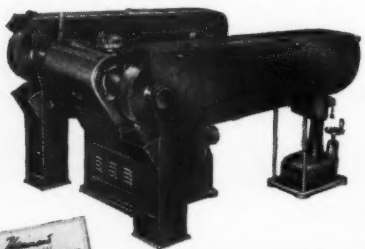

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INDUSTRY NEWS

SITUATION OPEN

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Address replies to MR-9A, The Monthly Review P.O. Box 168, Jenkintown, Pa.

WANTED

Immediately — General Foreman thoroughly skilled and experienced on semi and fully automatic nickel and chrome plating equipment. Write full application giving experience, qualifications, age, etc. Salary open.

Standard Steel Spring Company
Newton Falls Division
Newton Falls, Ohio

American Buff Company National Convention Held in Chicago

American Buff Company of Chicago, Ill., one of America's leading manufacturers of industrial buffs and polishing wheels, held their national convention in July in Chicago at the Shoreland Hotel.

Ben P. Sax, President, was host to salesmen and representatives from American Buff Company offices throughout the United States.

Demonstrations were held throughout the new American Buff plant at 2414 S. La Salle Street showing new methods of manufacturing. Other meetings were held on engineering, sales methods, advertising, new products and the inauguration of the "Pot of Gold" Sales Contest, a new incentive plan.

American Buff Company has two plants, one in Chicago and one near Atlanta, Ga. They have just developed a flame-proof material for the making of buffing wheels.

Bulletin Available on Corrosion-Resistant Coating for Plating Room Equipment

An informational folder giving complete details on uses and application of *Amercoat No. 33*, a corrosion-resisting coating for plating rooms and equipment, has been prepared by the *Amercoat Division, American Pipe and Construction Company*, P. O. Box 3428, Terminal Annex, Los Angeles 54, Calif. A copy of the bulletin with full technical information is available upon inquiry.

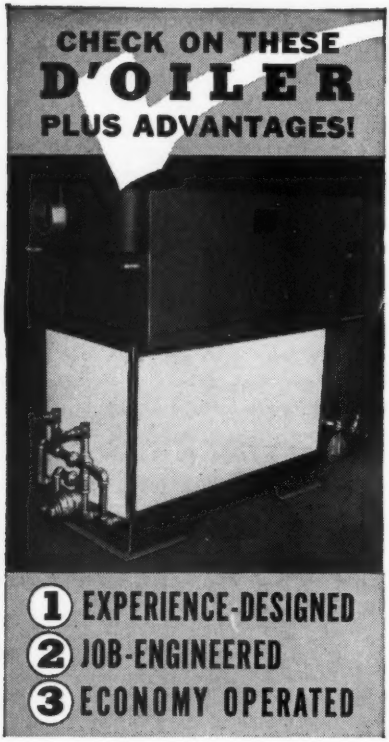
Article on the Selection of Aluminum Coatings

"*How To Select Coatings for Aluminum*" is discussed in an article by *Ray Swan* and *N. P. Ruther* of the Research Staff of the *Watson-Standard Company*, Pittsburgh, Pa. Finishes for aluminum must be prescription compounded for that use alone, the authors state, since aluminum possesses certain peculiar properties which make even first grade coatings for steel unsuitable for use with the light metal.

The article deals with aluminum castings, extrusions, forgings, sheets and foil and considers both functional and decorative coatings. A copy of the article will be sent without obligation upon request.

Du Pont Describes New Method for Polishing Stainless Steel

The *Du Pont Company* describes a new method for polishing stainless steel in an



FOR THOROUGH METAL CLEANING

The D'OILER Vapor Spray machine, illustrated above, can be used as a vapor-spray, or a straight vapor degreasing unit. Drain table recaptures dragout from basketed parts . . . all-around insulation reduces heat losses . . . exhaust duct on two sides safeguards operator . . . pump drive for standby solvent eliminates hand pouring.

Every D'OILER type is built to do a specific job . . . is designed with the "on-the-job experience" necessary to provide a degreaser that does the work, in the required volume, economically.

Our engineers will gladly advise on degreasing problems; your inquiries will receive prompt attention. Write today.

Mechanical
PROCESS COMPANY
P. O. BOX 88, SOUTH ORANGE, N. J.

operating manual, "*Du Pont Electropolishing Solution,*" just published. The technique, which makes use of a solution of glycolic acid, sulfuric acid, and water provides the metal finisher with a new, economical method. It is not expected to entirely displace mechanical finishing.

The electropolishing solution, according to the manual, remains liquid at room temperature. It operates over a wide range of current densities. Non-technical operators easily control and maintain the method at peak efficiency. Non-freezing characteristics of the solution eliminate temperature maintenance during periodic or week-end shut downs. Equipment used in electropolishing is substantially the same as for electroplating.

Savage with Standard Plating Rack

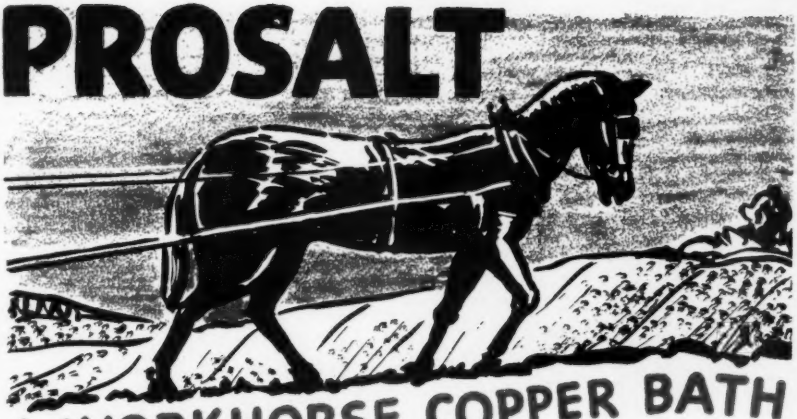
Frank K. Savage, formerly with Kuehne Manufacturing Company, Mattoon, Ill., has been appointed Asst. Vice-President of Standard Plating Rack Company, 1925 N. Paulina St., Chicago 22, Ill., according to announcement by Mac Schneider, President.

Mr. Savage is well known throughout the country through his many contributions to the plating art. He was President of the A.E.S. during 1945–46 and of the Chicago Branch.

"Platers Handi-Book"

The *J. C. Miller Company* of Grand Rapids, Mich., has compiled a 28-page, pocket-size booklet, "*Platers Handi-Book*". It is a ready reference of much used tech-

PROSALT



A WORKHORSE COPPER BATH

Top Quality at Lowest Cost!

PROSALT is a liquid addition agent for a copper cyanide bath used with direct current.

This PROMAT QUALITY product has many advantages—BROADER operating range; LOWER optimum temperature; Fine grained, lighter color, more ductile deposits. Existing Rochelle baths may also be converted by the addition of 130 cc. Prosalt per gallon.

Make-Up Analysis Prosalt Copper Bath	Cost
Copper cyanide, 3.5 ounces per gallon	$0.0764
Sodium cyanide, 4.6 ounces per gallon	0.049
Sodium carbonate, 4.0 ounces per gallon	0.0075
PROSALT, 130 cc. per gallon	0.184
	$0.3169 per gallon

PROSALT aids the cathode efficiency and you can expect deposits in the neighborhood of three-quarters of one thousandths in twenty minutes at forty amperes per square foot. The character of the deposit will be excellent for buffing and for stop-off for heat treatment and the color will be "lighter" than that obtained from a Rochelle bath. Adherence of the deposit will be excellent. The deposits on polished steel surfaces will be sufficiently bright to accept bright nickel immediately. Also, there will be no rinsing problem after PROSALT deposits.

PROSALT available f.o.b. Waukegan, Illinois, in twelve gallon carboys at $5.35 per gallon.

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4. Constant efficiency with varying loads.
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7. Thermostatic protection.
8. Units operate in room temperature up to 105° F.
9. Switches and pilot light on both basic and remote control units.

Rectification for Every Application

RICHARDSON-ALLEN CORP.
15 WEST 20th STREET, NEW YORK 11, N. Y.
Sales Engineers Located in Principal Cities
Manufacturers of the most complete line of standard Selenium Rectifiers

RICHARDSON-ALLEN
Selenium Rectifiers

nical information, containing charts and formulae for standard plating solutions and operating conditions, average cathode current efficiencies, electrochemical equivalents, metal content of plating salts, metal deposits table, tank capacities, conversion tables and other material.

This booklet is available, free, by writing to the J. C. Miller Company, 55 Mt. Vernon, N. W., Grand Rapids 4, Mich.

Demineralizer Low Cost, Simplified Unit

The *"Filt-R-Stil" Water Demineralizer Model U-60* is designed to transform ordinary tap water into the chemical equivalent of distilled water, at a fraction of the cost of distilled water. Model U-60's easy operation and maintenance offer notable advantages in water treatment; it requires no heat, steam, or auxiliary equipment, and consumes only enough electricity to light a 6 watt bulb.

Designed to operate at a 60 gph flow rate, it can be used to deliver water containing a maximum of 10 ppm of ionized solids, or as little as 1 ppm. A built-in controller indicates the actual quality of all water treated leaving the unit. No auxiliary analytical tests are required.

Model U-60 is ready for operation as shipped; it requires only connection to raw water line, drain, and electrical outlet.

Among users are enamelers, electroplaters, and manufacturers in numerous fields in which water is a raw material or processing medium. It is made by *American Cyanamid Company*, 32 Rockefeller Plaza, New York 20, N. Y.

Tungsten Carbide Balls Made to Specifications

Tungsten Carbide Balls can be furnished in any size and with any desired degree of dimensional accuracy, and special sizes can be produced in small quantities when required. The balls are particularly useful in burnishing and polishing operations since they retain their size for a long time. Their hardness and corrosion resistance make them valuable for use in check valves, particularly for pumping equipment.

For special applications, as in tube drawing and bending equipment, the balls can

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recent completion of an addition that increases our floor space forty per cent. The original building, purchased in 1942 (our tenth year), was doubled in size in 1944...

NORTHWEST CHEMICAL CO.

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When raw materials again in supply, we furnish you with n products, laboratory veloped and product tested, that we are s will be in great dema

pioneers in pH cleaning . . . serving you since '32

be furnished with holes to permit attachment of wires and cables. High compressive strength in addition to hardness enhance their desirability for special bearings and anti-friction mountings. Manufacturer is *Industrial Tectonics, Inc.*, 3600 Jackson Road, Ann Arbor, Mich.

Abrasive Selector for Sanding and Finishing Jobs

This comprehensive slide rule type *Abrasive Selector* offers the finishing industries a convenient, graphic compilation of recommendations for the use of coated abrasives, rubbing and polishing agents. Durable, designed in three colors for quick reading, it indicates the proper abrasive combinations for 120 specific sanding and finishing problems by showing kind of abrasive for the job, abrasive grit sizes for various finishing operations on many materials, type of coating, lubricant to be used, if any, and proper pad to be used. Marginal notes contain information of value in specific applications. Manufacturer is *Sterling Tool Products Company*, 155 E. Ohio Street, Chicago 11, Ill.

Coil Centering Reel Automatic, Heavy Duty Unit

The heavy-duty, automatic *Centering Reel* shown for handling coils weighing up to 2500 pounds accepts coils of 18-inch maximum width and 40-inch O. D. It can be supplied with expansion from 14½ to 18½ inches or 17½ to 22½ inches, and is available with or without motor. Motor driven reel is equipped with a 1½-hp motor, 220/440 v, 3-phase, 60 cy, 1200 r.p.m. Automatically centering the coil, it permits easy, continuous, smooth feeding of the stock for rapid and accurate work. The plain reel is equipped with a brake. Manufacturer is *F. J. Littell Machine Company*, 4127 Ravenswood Avenue, Chicago 13, Ill.

Inorganic Cleaner for Plant Maintenance

A general purpose cleaner for maintenance work and suitable to other uses, "*Pennsalt MC-1*," is a dry, granular, inorganic material that dissolves quickly in water, removes most types of soil easily and rinses rapidly.

Intended for cleaning walls, floors, wood-

CHROMIUM
NICKEL
COPPER

Simple test sets for aid in controlling plating and other solutions.

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Specify Kocour Sets from your supplier.

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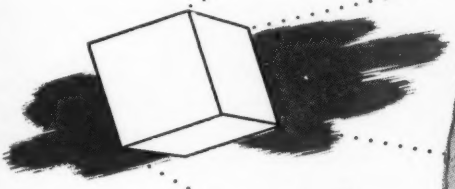
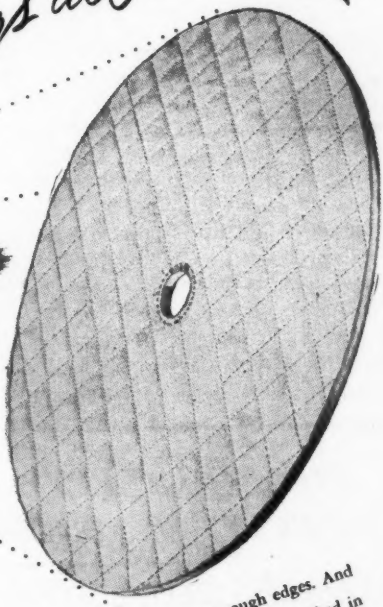




All around the edges of Duluth Square Sewed Buffs, you'll find a constant whirl of savings . . . for these quality Buffs are so sewed to form pockets where the stitches run out . . . pockets that collect sufficient abrasive materials to bring you *substantial savings*.

Moreover, Duluth Square Sewed Buffs provide you with the greatest possible quality that only a combination of high grade materials and workmanship can furnish.

With these Buffs a soft pliable face is always presented to the work . . . stitching is at right angles so as not to apply rough edges. And Duluth Square Sewed Buffs are furnished in the same grades as other full disc or pieced Buffs.

Write for Complete Information Today.

DULUTH BUFF COMPANY
DULUTH, GA.

work, windows, and for use in industrial washing machines, it may be used in steam gun cleaning. Two to four pounds are adequate for 50 or 55 gallon tank of the vapor spray machines. In tumble barrel cleaning, two to eight ounces per gallon of water are recommended. It is mild, harmless to clothing or skin, and acts as a water conditioner and soap saver. Manufacturer is *Pennsylvania Salt Manufacturing Company*, 1000 Widener Building, Philadelphia 7, Pa.

Selenium Rectifier Unit for Electroplating, Anodizing

The *Crown Model 815 Selenium Rectifier Unit* includes among its components a large, 4½-inch rectangular type voltmeter of 0-20 v range and an ammeter of 0-750, 0-1500 amp range, both ranges full scale. Terminals for changing rates and connection to tank or barrel are provided, ranges being 0-8 v, 1500 amp, and 0-16 v, 750 amp. Push buttons for on-off control of the unit are a feature, and installation is simple requiring only connection to ac supply and to tank or barrel. Air intake duct is used if local air is corrosive or above 95° F.

Three thermoswitches near rectifier elements are factory set to interrupt main contactor and shut down unit if temperature rise is abnormally high due to overload or other cause. An auto-wound voltage control transformer with coarse and fine taps on each phase provides full range control from zero to maximum, and balanced input to rectifier elements at any setting. Double wound-stepdown transformer supplies rectifier elements. Both are continuous duty type with fibre-glass and mica insulation. Rear door provides immediate access, and a safety switch on the door keeps main contactor open preventing operation while door is open.

Initial efficiency is approximately 63 per cent leveling off to 55 to 57 per cent after about 10,000 hours' use. There is no further drop after this stabilization period. Maximum voltage will not drop below 8 v on 1500 amp range or below 16 v on 750 amp range. Manufacturer is *Crown Rheostat and Supply Company*, 3465 N. Kimball Avenue, Chicago 18, Ill.

FOR QUALITY AND UNIFORMITY SPECIFY **HARRISON 4A PRODUCTS**

STAINLESS STEEL BUFFING & POLISHING COMPOUNDS

Faster Cutting—Increased Production—Economy

DOUBLE HEADER COMPOUNDS

Sizes: 150—180—220—240—320

COMPOUNDS FOR SPRAYING OR DIPPING

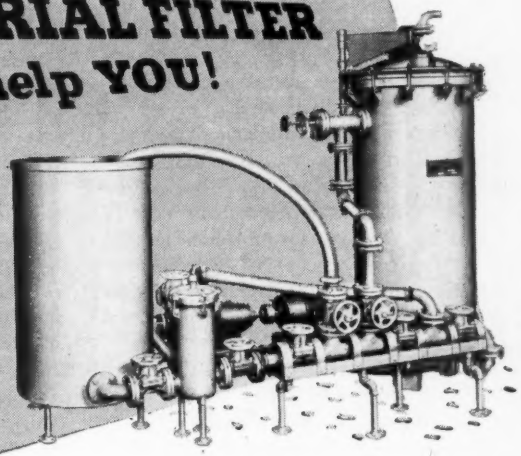
Use 4A Cement and Thinner—For Setting up Wheels, Belts, Rolls, etc.—Longer Life—Greater Production

Consult Us On Any of Your Problems
We'll Gladly Advise and Send Samples

HARRISON & CO. INC.
Haverhill, Mass.

A modern INDUSTRIAL FILTER will help YOU!

- Cut your plating costs
- Speed up production
- Produce quality plating
- Eliminate numerous plating troubles



Only CLEAN plating solutions can produce clean, non-porous plated coatings. The low cost for clarifying plating solutions with INDUSTRIAL FILTERS is really a saving as rejects are reduced and quality is greatly improved. Continuous clarification (filtering) also creates a beneficial circulation.

Illustration of a typical large capacity complete stationary filter system designed to provide adequate filtration on large automatic plating machines. Arrangement consists of filter, pumping unit, primer-strainer unit, mixing tank, control valves, fittings and piping. These features facilitate the convenient use of filter aids and purifying agents, making it an ideal continuous filtration system, equally effective for intermittent filtering. Systems are provided for either acid or alkaline solutions.

FOR TWENTY YEARS "INDUSTRIAL" HAS BEEN BUILDING PLATING SOLUTION FILTERS THAT HAVE ENJOYED AN OUTSTANDING REPUTATION FOR: RUGGEDNESS, DEPENDABILITY, LOW UPKEEP COST, LONG LIFE AND BED ROCK OPERATING ECONOMY. THAT'S WHY SO MANY PLATERS SAY: I PREFER THE "INDUSTRIAL" WAY.

INDUSTRIAL
FILTER & PUMP MFG. CO.
1821-39 WEST CARROLL AVENUE • CHICAGO 12, ILLINOIS

Skin Protection for Bright Metal Surfaces

Recently developed by *Dennis Chemical Company*, 2700 Papin Street, is a new, protective, liquid-plastic coating for polished or bright metal called "*Redskin*". Coating is applied simply by spray, brush or dipping on bright metal surfaces. Dries quickly forming a tough, elastic film that is impervious to rust, chemical reaction, smears, or normal handling. Red color instantly warns against promiscuous rough handling of bright or polished surface. When desiring to uncover bright surface, edge is picked up with finger nail and coating peeled off entire surface in one continuous strip. Parts protected with this new coating may be completely fabricated before removing protective "skin". Assembled items may be coated for storage or for protection in shipping. It is not affected by atmosphere or climatic changes. Manufacturer can make immediate delivery. Full information and sample upon request.

Hammond Model OD-1 Centerless Wet-or-Dry Grinder-Polisher

The *Hammond Machinery Builders, Inc.*, Kalamazoo, Michigan, announces a new addition to its line of grinding and polishing equipment. It is known as the *OD-1 Cylindrical Grinder-Polisher* for rods, bars and tubes from $\frac{1}{8}$" to 1-$\frac{1}{4}$" diameter.

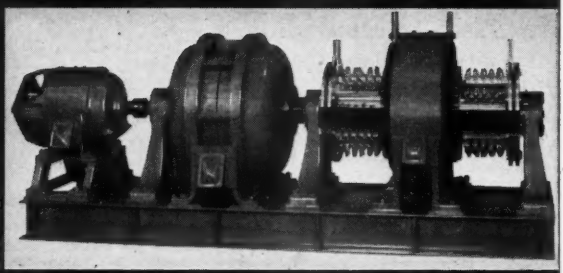
The OD-1 is a centerless machine using coated abrasive belts for grinding and polishing. For stock removal it will remove up to 0.005" per pass on ferrous metals and up to 0.010" on non-ferrous. Work supports will handle $\frac{1}{2}$" bars up to 18' long and 1" bars up to 8' long. Accuracy 0.001" on production items—closer limits on some work.

The endless abrasive belt is 4" wide, 60" long, and may be operated dry or wet with coolant. Wet operation is recommended as it gives better finish, does not discolor work from heat, and gives higher production and longer belt life.

Two methods of feeding are employed—through-feed and in-feed. The through-feed method is generally used and is accomplished by swinging the regulating wheel on it horizontal axis from zero to 12°. The rate of feed can be varied from zero to 18' per minute.

Although Hammond has just announced the OD-1, the machine is not new to them in that the first OD-1 was exhibited at the National Metal Congress in Cleveland in

COLUMBIA MOTOR GENERATORS



FOR ELECTRO-PLATING

Columbia Generators embody every feature essential for dependable, 24-hour operation. They are built for electroplating service in sizes of 6 to 20 volts, 500 to 20,000 amperes, for anodic treatment of aluminum in sizes of 40, 50, and 60 volts, 500 to 3,000 amperes. Columbia Generators for other electrolytic processes range from ½ to 250 KW, 100 to 40,000 amperes, 6 to 60 volts. Write for full information.

COLUMBIA ELECTRIC MFG. CO.

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FREE LITERATURE ON RECTIFIERS

Check this list . . .

- ☐ "Selectro-Platers" (12-page booklet describing complete three-phase line, 6 to 50 volts, 100 to 5000 amperes)
- ☐ "Bench Rectifiers" (single-phase units for laboratory work, 6 to 16 volts, 25 to 150 amperes)
- ☐ "Multi-Rectifiers" (flexible, universal DC power supply units for laboratory and test work)
- ☐ "Rectifiers for Electroplating" (reprints of series of current articles describing theory, construction, and operation of metalplate rectifier equipment)
- ☐ "Rectifier Installations" (4-page article summarizing proper installation and maintenance of metalplate rectifiers)
- ☐ "Selenium vs Tube Rectifiers" (brief discussion of factors determining choice between metalplate and various types of tube rectifiers)
- ☐ "Rectifier Requirements" (questionnaire forms to facilitate statement of problem for quotation on custom-built rectifier equipment)

Any or all of the above will be sent, free, on request

W. GREEN ELECTRIC COMPANY, INC.
GREEN EXCHANGE BUILDING 130 CEDAR STREET NEW YORK 6, N. Y.

1944 and sold at the show. This machine has now given more than two years of satisfactory service.

The OD-1 is now in production and on about a four weeks' delivery basis. For further information write to Hammond Machinery Builders, Inc., 1613 Douglas Ave., Kalamazoo, Michigan.

Aprons and Sleeves of Seamless Plastic

A new line of *Protective Apparel*, "*Nitroflex*" aprons and sleeves, is made of a multipurpose, clear, frosted plastic material for protection against most acids, caustics, oils and solvents. Light, flexible, and comfortable wearing, this tough material resists snagging, abrasion, and wear. All seams are made by electronic sealing.

Aprons are fitted with reinforced grommets and furnished with tubular laces of the same material. Sleeves are 14 inches long, comfortably patterned, and fitted with adjustable elastic bands at both ends.

Three weights, light for laboratory technicians, medium for more severe operations, and heavy for battery handling, plating, etc., are obtainable. Manufacturer is *Industrial Products Company*, 2811 N. 4th Street, Philadelphia 33, Pa.

Lubricant and Cleaner Catalogue

This sixty-page catalogue is subdivided into seven sections covering lubricants for wire drawing, tube drawing, deep drawing and stamping, and cutting and grinding, a section on cleaning compounds, another on miscellaneous compounds, and a final group of ready reference charts. Products' uses are fully described and illustrated in single page data sheets each devoted to one lubricant or cleaner. It is durably bound in fabrikoid covered boards and printed in looseleaf style for up-to-date collating as new sheets are issued. Available from *Apex Alkali Products Company*, 4300 Main Street, Philadelphia 27, Pa.

Clear Dip for Zinc Produces Bright, Corrosion-Resistant Finish

Unichrome Clear Dip, a simple chemical treatment for new zinc plate, has recently been developed by *United Chromium, Incorporated*. It produces a brilliant conversion coating on ordinary zinc plate. Tests show this treated zinc withstands more than fifty hours of standard salt spray exposure without dulling or formation of white corrosion.

The process is fast, with good results obtained at room temperature. Actual dipping

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PICKLING and DRYING of METAL PARTS
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PICKLERS
Standard and Special Types of equipment from the smallest to the largest sizes for a wide variety of metal degreasing, washing, cleaning, rinsing, pickling, drying and allied operations.
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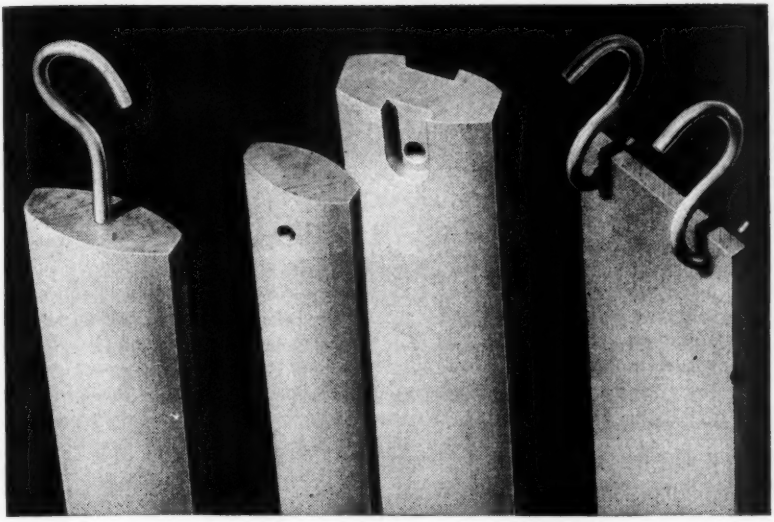

Anaconda means Purity in Copper Anodes

WHEN YOU SPECIFY ANACONDA, you are assured of unexcelled purity... less than 0.01 percent of total metallic impurities... an advantage that pays off five ways:

1. **Copper goes into solution faster and more uniformly.**
2. **The highest quality deposit is produced in the shortest possible time.**
3. **Slime is reduced to an absolute minimum.**
4. **Spotting and discoloration of the deposit are minimized.**
5. **Scrap losses are exceptionally low.**

In addition to copper, Anaconda Anodes are furnished in brass and bronze... rolled Sheet or Oval... cut to your own specifications or standard sizes... drilled or undrilled... with or without hooks—also "cathode-anodes." For present or future reference, write for Publication C-5. 47272

THE AMERICAN BRASS COMPANY

General Offices: Waterbury 88, Connecticut

Subsidiary of Anaconda Copper Mining Company

In Canada: ANACONDA AMERICAN BRASS LTD., *New Toronto, Ont.*

time is from 5 to 20 seconds—with several water rinses preceding and following the dipping. Acid-proof or suitably coated tanks and dipping baskets are used.

Unichrome Clear Dip makes zinc a practical product finish. Treated surfaces have a brighter finish; get better resistance to discoloration than with cadmium; are non-fingermarking and have excellent "shelf-life". This new treatment also forms an excellent primed surface for any clear lacquer or pigmented organic coating. For more details, write for 4-page *Bulletin CC-1*, United Chromium, Incorporated, 51 E. 42nd Street, New York 17, N. Y.

Laboratory Instruments Charted

A two-page chart (R-1066) titled "*Basic Characteristics of Useful Industrial Laboratory Instruments*" has been announced by *North American Philips Company, Inc.*, 100 E. 42nd Street, New York, N. Y.

Data is presented in a convenient form in order to facilitate hanging on the wall for ready reference.

Seven vertical columns have the following headings: Apparatus or System, Principle, Basic Arrangement, Operation, Application, Comments, and Manufacturers or Suppliers.

Fifteen instruments are covered in the tabulation and include the following: Colorimeter, Cyclograph, Electron Microscope, Geiger-Counter X-ray Spectrometer, Magnaflux, Mass Spectrometer, Photometer, Photelometer, Spectrograph, Spectrophotelometer, Spectrophotometer, X-ray Diffraction, Zyglo, Electron Diffraction and Supersonic.

Acme Liquid Composition

The *Hanson-Van Winkle-Munning Company* of Matawan, N. J., announces that they have perfected four grades of a new liquid tripoli composition, *Acme No. 2-L-70, 2-L-75, 2-L-77*, and *2-L-79*.

The company has also entered into an agreement with *Eclipse Air Brush Company* for the distribution of their equipment for the application of these liquid tripoli compositions, and is, therefore, prepared to supply complete installation and service.

The characteristics of the new Acme Liquid polishing compositions are given below:

Grade	*Characteristics*
2-L-70	Double duty with superior color
2-L-75	Medium cut with good color
2-L-77	Good cutting with medium color
2-L-79	Heavy cut with medium color

These compounds have been tested in production for a number of months and each grade has demonstrated marked efficiency.

Acme liquid tripoli can be used with any approved type of spray equipment but if the operator has never used liquid compounds before, Eclipse spray equipment is recommended by the manufacturer. The pressure method of feeding liquid tripoli to the wheel is said to be preferable to the gravity feed.

Where liquid compositions can be suitably applied, these apparent advantages over bar type are claimed:

Large savings in amount of compositions used

Considerable savings in buffs

Higher color per degree of cut

Ease of application

Full details are available from the Hanson-Van Winkle-Munning Company.

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FELT WHEELS

Quality • Better Work • Uniformity

Order PARAMOUNT BRAND Felt Wheels from your supplier. Also, bobs and sheets whenever you need them.

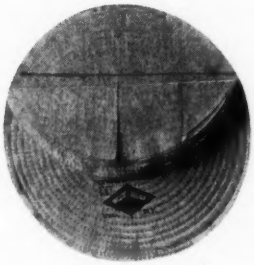
BACON FELT CO. Winchester, Mass.

Established 1824

"America's Oldest Felt Manufacturer"

DIVINE SEWED PIECED BUFFS

VERSATILE — ECONOMICAL — AVAILABLE



Spirally sewed, ⅜", ¼", in a variety of grades—Bleached, Unbleached, Colored . . . uniform in quality . . . excellent in finish . . . built in balance . . . full diameter . . . economical to use. Since 1892 the standard of quality in pieced buffs. Available for prompt shipment.

Polishing and buffing equipment is our specialty. Write us about your problems . . . we have a product to meet your every need!

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UTICA 1, N. Y., U. S. A.

THE ABBOTT BALL COMPANY, HARTFORD 10, CONN.

Polishing Lathe First of New Line

Model 400 in a new line of *Polishing Lathes* for toolrooms, laboratories, foundries, platers, jewelers, and plastic manufacturers is the first of five units of varying sizes and types. Operating at lower cost, in small floor space, and with greater efficiency, it is equipped with a self-contained dust-collecting unit. Ball bearing 1725 r.p.m. motors of standard characteristics are used.

Polishing head and cover tray are cast aluminum with two sets of standard ball bearings on which the spindle revolves. Spindles are tapered but can be replaced by straight type if desired. Each wheel has its own collector. A fabric dustbag immersed in water on the exhaust end of the fan housing removes easily for cleaning. A single motor operates all processes of the machine. Two foot rests, ample room for two operators, and brilliant, non-straining lights are additional features. Manufacturer is *Ralph Hochman & Company*, 56-A Edison Place, Newark, N. J.

Bonderizing vs. Infra-Red Burn-off

Parker Rust Proof Company of Detroit, Mich., has sent us a letter dated July 1 which reads in part:

"We note an article in the June, 1947 issue of THE MONTHLY REVIEW, page 745, in which the following statement is made:

'For example, in the most outstanding installation from the standpoint of technical proof and information an Infra-Red Burn-Off oven replaced an alkali wash, two rinse tanks, a bonderite tank and an acid bath.'

"We take exception to this article and feel that either an explanation or retraction is in order as we know of no place where present or past customers have removed cleaning and Bonderizing equipment and replaced it with a Burdette burn-off oven.

"While burn-off ovens were quite generally used some years ago as a method of preparing metals for paint they have generally fallen into discard."

The two last paragraphs quoted were submitted to the *Burdette Manufacturing Company*, Chicago, with a request for a rejoinder for publication. No reply has been received to date.

ZINC PLATERS!

Cleanse & Purify your Zinc Solution with

McKeon's

Zinc-Brite

TRADE MARK REG'D.

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Custom-Built

TANKS

For Cleaning, Pickling and Plating

● For 39 years leading manufacturers have relied on Kirk & Blum for custom-built tanks to meet their individual production requirements.

We are equipped to fabricate tanks of Steel, Lead or Rubber Lined, Monel Metal, Stainless Steel, Copper, Aluminum, Inconel, etc.

Tanks are supplied with or without exhaust ducts and fans as conditions or specifications indicate.

KIRK AND BLUM

The KIRK & BLUM Mfg. Co.
2887 Spring Grove Ave.
Cincinnati 25, Ohio

PERMA-PLUGS STOP TANK LEAKS *Instantly!*

This is the modern way to avoid costly shut-downs due to punctured tank linings. When an accident occurs resulting in damage to the rubber lining, drill a hole through the tank, insert a Perma plug and you are ready for operation again.

The time necessary for making this type of repair is about 15 minutes. Contrast this with the old way of calling in a specialist to patch the rubber lining, which at best was only a make-shift job. Perma plugs are rubber covered and will outlast the tank. Simplify your maintenance problem by keeping a supply of Perma plugs ready for use when necessary.

The above illustration shows the modern method of stopping leaks with Perma Plugs.

In addition to the plug illustrated, we can also furnish special shaped plugs, such as squares, oblongs and ovals.

PERMA-LINE RUBBER PRODUCTS *Corporation*
Manufacturers Rubber Specialties
1755 N. WINNEBAGO • CHICAGO 47, ILL. • HUMBOLDT 5800

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"YANKEE BRAND"

PROGRESSIVELY BETTER
ABRASIVE COMPOUNDS

Tailored to fit all finishing requirements.

Inquiries respectfully solicited

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(est. 1919)

Manufacturers

BUFFING COMPOSITIONS
FOUNDRY FACINGS

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Reg. U. S. Pat. Off.

FOR NICKEL PLATING

The one bath especially designed for plating diecastings made of WHITE METAL ALLOYS including ZINC, LEAD, and ALUMINUM.

USE
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ADDITION AGENTS
for
HARD CHROMIUM BATHS

Finer-grained deposits.
Increased throwing power.
Less sensitivity to sulfate content.

ZIALITE CORPORATION
92 Grove Street, Worcester 5, Mass.

PLATERS

THE FOLLOWING EXCELLENT REBUILT AND GUARANTEED ELECTROPLATING MOTOR GENERATOR SETS, WITH FULL CONTROL EQUIPMENT, AT REDUCED PRICES:

1—15,000/7500 AMPERE, 6/12 VOLT, **COLUMBIA ELECTRIC COMPANY** Latest Design Units, with Separate M. G. Exciters.
1—5000/2500 AMPERE, 10/20 VOLT, **HANSON-MUNNING COMPANY,** Synchronous Motor Drive. Built 1941.
2—5000/2500 AMPERE, 9/18 VOLT, **CHARLES F. L'HOMMEDIEU** "RELIANCE" Units. Synchronous Motor Drive. Latest Design.
2—5000/2500 AMPERE, 6/12 VOLT, **A. P. MUNNING COMPANY** "OPTIMUS" Design, Separately Excited.
1—4000/2000 AMPERE, 6/12 VOLT, **HANSON & VAN WINKLE COMPANY,** Compound Wound, Separately Excited.
1—2500/1250 AMPERE, 6/12 VOLT, **HANSON & VAN WINKLE COMPANY,** Shunt Wound, Separately Excited.
1—2000/1000 AMPERE, 10/20 VOLT, **COLUMBIA ELECTRIC COMPANY,** 25° Unit, with Synchronous Motor Drive.
1—2000/1000 AMPERE, 6/12 VOLT, **HANSON-MUNNING**—40° Unit. Interpole Design, Separately Excited.
1—1500/750 AMPERE, 6/12 VOLT, **ELECTRIC PRODUCTS COMPANY,** Separately Excited, Ball-bearing Design.
1—1500/750 AMPERE, 12/24 VOLT, **CHANDEYSSON ELECTRIC CO.** Unit. Synchronous Motor Drive. Direct Connected Exciter.
1—1500 AMPERE, 40 VOLT, **HANSON-MUNNING,** Anodizing Synch. M. G. Set, Automatic Controls.
1—1000 AMPERE, 40 VOLT, **CHANDEYSSON,** Anodizing Synch. M. G. Set, Automatic Controls.
1—1000 AMPERE, 25 VOLT, **HANSON-VAN WINKLE-MUNNING COMPANY** Separately Excited, Anodizing Unit.
OTHER SIZES OF ANODIZING M. G. SETS—in stock for Sulphuric or Chromic Acid Solutions—Large selection. Write for details.
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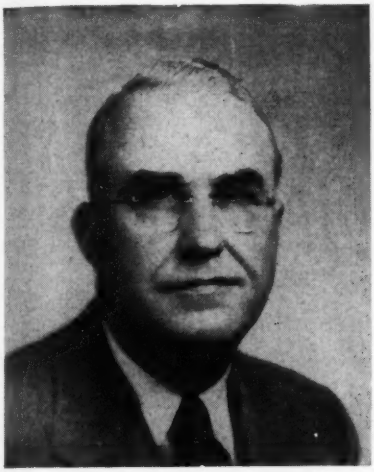

James Poulson has been shifted to the Pacific Coast, with headquarters in the Los Angeles Office of the Wyandotte Organization. He has serviced Wyandotte industrial accounts in the Milwaukee territory since 1938. Mr. Poulson may be reached through the Seattle, San Francisco, and Los Angeles Offices of Wyandotte Chemicals Corp.

Robert J. Racine replaced Jim Poulson as Wyandotte Industrial Department Representative in Milwaukee.

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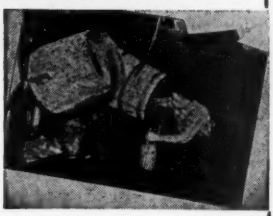

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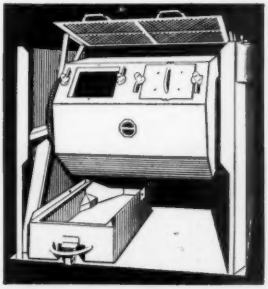

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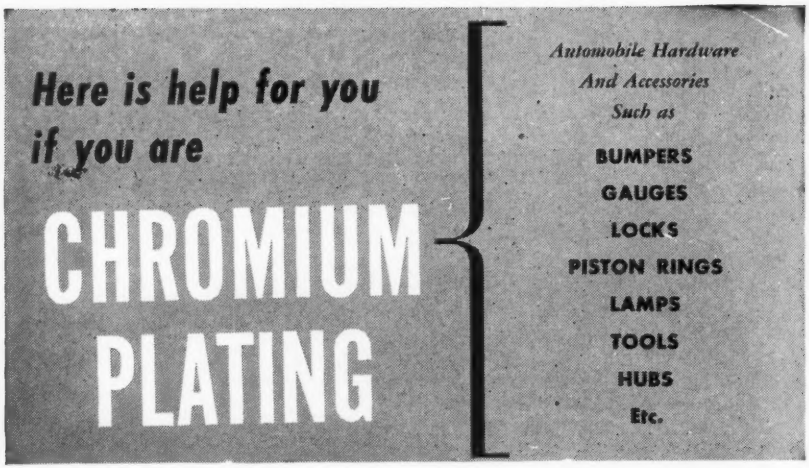

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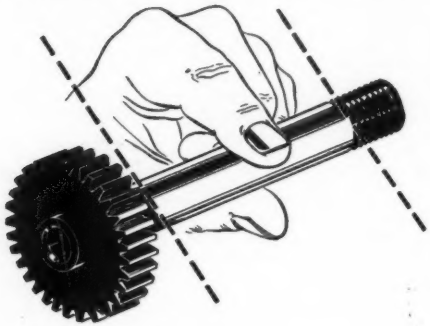

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LETTER FROM THE EDITOR

September 1, 1947

Dear Reader--

If you read the Executive Secretary's report in the June issue, you may have noticed the record that THE MONTHLY REVIEW established for itself during the fiscal year 1946-1947. In fact, from your inspection of the table contained in the report you may have concluded that 1946-1947 was the biggest year yet in the 34 years of publication--and justifiably so.

From May, 1946, to April, 1947, THE REVIEW published a whopping volume of 1,408 pages, the largest edition during any one fiscal year to date. In the year ending April, 1921, for example, the total number of pages was 288. By 1931 this had increased in in number to 556 pages. During the past six years there has been a steady rise from the 1,048 pages published in THE REVIEW by April, 1941, until today's total of over 1,400 pages--nearly 2½ inches in thickness--has been reached.

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Sincerely,

Gustaf Soderberg

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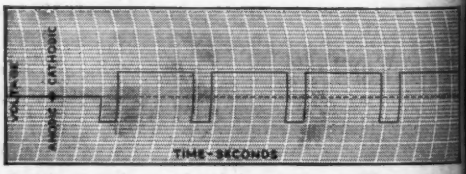

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